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NATIONAL DAM SAFETY PROGRAM. WOODRIDGE LAKE DAM (MO 11005), MIS--ETC(U)
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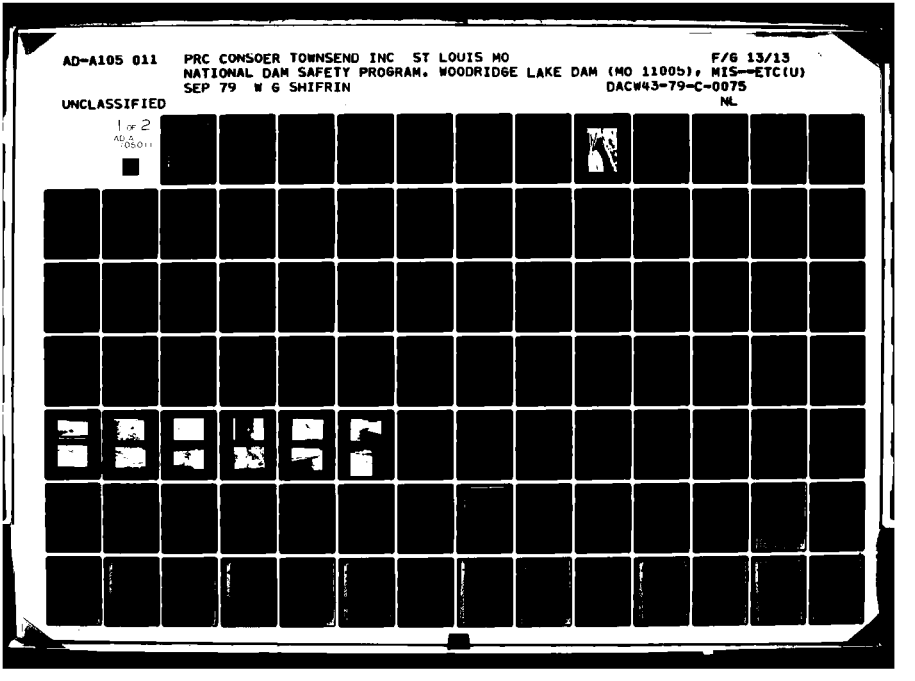

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WOODRIDGE LAKE DAM

WARREN COUNTY, MISSOURI

MO 11005

(9) Final rept.,

(11) Sep 79

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DACW43-79-C-0075

(10) Walter G. /Shifrin

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Woodridge Lake Dam (MO 11005)
Mississippi - Kaskaskia - St. Louis Basin
Warren County, Missouri. Phase I Inspection Report.

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER, 1979

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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105011	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Woodridge Lake Dam (MO 11005) Warren County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.	8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0075
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE September 1979
	13. NUMBER OF PAGES Approximately 80
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)* UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Woodridge Lake Dam (Mo. 11005) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Woodridge Lake Dam (Mo. 11005).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: _____ _____
Chief, Engineering Division Date

APPROVED BY: _____ _____
Colonel, CE, District Engineer Date

WOODRIDGE LAKE DAM
WARREN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 11005

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES LTD.
ST. LOUIS, MISSOURI
AND
ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

SEPTEMBER 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Woodridge Lake Dam, Missouri Inv. No. 11005
State Located: Missouri
County Located: Warren
Stream: Unnamed Tributary of Dry Fork
Date of Inspection: May 16, 1979

Assessment of General Condition

Woodridge Lake Dam was inspected by the engineering firms of Consoer, Townsend, and Associates Ltd. of St. Louis, Missouri and Engineering Consultants, Inc. (a joint venture) using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The estimated damage zone extends approximately 5-1/2 miles downstream of the dam. Within this zone are eleven dwellings and seven outbuildings which may be subjected to flooding, with possible damage and/or destruction, and possible

loss of life. Woodridge Lake Dam is in the intermedite size classification since it is more than 40 feet high, but less than 100 feet high.

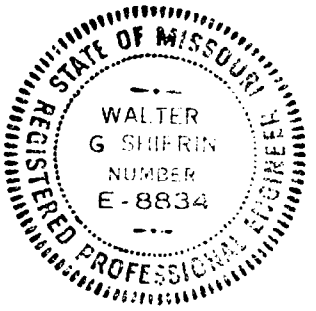
Our inspection and evaluation indicates that the spillway of Woodridge Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Woodridge Lake Dam is a intermediate size dam with a high hazard potential required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Since there is high hazard potential downstream of the dam, the appropriate spillway design flood for this dam is the Probable Maximum Flood. It was determined that the reservoir/spillway system can accomodate 27 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation indicates that the reservoir/spillway system will accomodate the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were the deep erosion gullies along left and right abutments contacts, wave erosion on the upstream embankment slope, undercutting at the discharge end of the service spillway pipe and poorly channelized exit for the emergency spillway discharges. The lack of stability and seepage analysis on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

Walter G. Shifrin, P.E.



Overview of Woodridge Lake Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

WOODRIDGE LAKE, I.D. No. 31140

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

WOODRIDGE LAKE DAM, Missouri Inv. No. 11005

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Woodridge Lake Dam was carried out under Contract DACW 43-79-C-0075 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Woodridge Lake Dam was made on May 16, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an assessment of hydrologic and hydraulic conditions at the site; presents an assessment as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing, and detailed analyses were not within the scope of this study. The conclusions drawn herein, therefore, are based on the presence of, or absence of, obvious signs of distress. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

Two drawings for Woodridge Lake Dam were obtained. These drawings are given as plates in this report. The drawings do not appear to be as built drawings, and the dimensions and elevations are, therefore, approximate. The description below is based primarily on observations and measurements made during the visual inspection, supplemented by information shown on the drawings.

The dam embankment is a compacted earthfill structure. The drawings show the dam to have a clay core with a top width of 20 feet, and a bottom width of 50 feet. A clay cutoff trench is also shown on the drawings to have been constructed. This cutoff trench is shown to have a bottom width of 20 feet, a height of 5 feet, and side slopes of 1V to 3H.

The crest, which functions as a sand and gravel surfaced roadway is 25 feet wide. The crest length is 485 feet, and the crest elevation is approximately 821.0 feet MSL. The hydraulic height of the embankment is 58.5 feet, and the 5 foot high cutoff trench makes the structural height equal to 63.5 feet.

The downstream slope of the embankment was measured as 1V to 2.75H. The drawings show the upstream slope to be 1V to 3H. One notable difference in slopes is a horizontal berm about seven feet below the crest on the upstream side. This berm could be seen under water. No riprap was placed on the upstream slope. The entire exposed embankment with the exception of the roadway crest and some erosion gullies had a

grass cover. From exposures in erosion gullies the embankment material appears to be mainly residual soils containing much gravel and sand.

The dam is situated on the border between the Dissected Till Plain Section of Central Lowlands Physiographic Province which extends to the north and the Ozark Plateau Province to the south. Although the area in which the dam and reservoir are located was glaciated during Pleistocene time, the till and loess which characterize the uplands of the Till Plains have been largely removed by erosion since the end of the Pleistocene. The area is characterized by wooded hills which have gentle to steep slopes.

The bedrock geology of the area, as shown on the Geologic Map of Missouri (1979), typically consists of gently northeastwardly dipping (ca. 30-50 feet/mile) sediments of Paleozoic age. To the north of Warren County these beds are often capped by young (Pleistocene) deposits of glacial drift and wind blown loess. In southern areas of the county the bedrocks is generally covered by residual soil, colluvium, or alluvium. The rocks underlying the area are predominately carbonates (limestones and dolomites), although beds of sandstone and shale are not infrequent.

The bedrock of Warren County contains some minor folding. The largest known geologic structure in the area is a gentle anticline centered about 2 1/2 miles northwesterly of the town of Warrenton. This fold may have affected the beds at the damsite.

Woodridge Lake Dam contains two spillways. The service spillway is a 36 inch diameter vertical drop inlet steel pipe located 340 feet from the right abutment of the dam. Ten feet from the top of the pipe a 24-inch diameter corrugated metal pipe connects to the steel drop inlet pipe. This corrugated metal pipe was constructed through the embankment to a discharge point at the downstream toe of the dam. A steel anti-vortex plate and a trashrack made of #4 reinforcing bars are located at the intake to the drop inlet pipe. The downstream end of the service spillway discharges into a pool just downstream of the toe of the dam.

The emergency spillway is an open channel located at the left abutment of the dam. The channel crosses the road. The spillway is V-shaped, with a total width at the top 74.0 feet and side slopes of approximately 1V to 22H on the left bank and 1V to 30H on the right bank. The maximum depth of the spillway is 17 inches.

There is no operating outlet pipe or low level drain pipe at the dam.

b. Location

Woodridge Lake Dam is situated on a small intermittant stream about 1000 feet upstream of its confluence with the intermittant Dry Fork. Dry Fork flows about 7 miles in a generally southerly then southeasterly direction to Charette Creek which joins the Missouri River about four miles to the southeast near Marthasville, Missouri. The main access to the dam and lake from Warrenton, Missouri, is south on State Highway No. 47 approximately 2 miles to a small gravel road. The dam and lake is located 1/2 mile west of the State Highway off of the gravel road. The damsite is shown on the Warrenton

Quadrangle Sheet (7.5 minute series) in Section 5, Township 46 North, Range 2 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Small" since its storage is less than 1,000 acre-feet. The dam is classified as "Intermediate" in dam size category because its height is more than 40 feet, but less than 100 feet. The overall size classification is governed by the larger of the two determinations, and the classification is, accordingly, "Intermediate" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. The estimated damage zone extends approximately 5-1/2 miles downstream of the dam. Within this zone, eleven dwellings and seven outbuildings may be found.

e. Ownership

Woodridge Lake Dam is owned by Woodridge Trustees. The mailing address is Woodridge Trustees, c/o Mary Grubb, P. O. Box 339, Warrenton, Missouri, 63383.

f. Purpose of Dam

The main purpose of the dam is to impound water for recreational use for landowners adjacent to the dam.

g. Design and Construction History

Woodridge Lake was designed in 1975 by Stolwyk, McDaniel, Ferrenbach of Clayton, Missouri. A limited set of plans has been made available for this report.

The lake was designed for recreational purposes only and is exclusively used by the residents of Woodridge. The contractor for the construction in 1975 was Norvell Construction of 3320 Hermoso St., St. Louis, MO.

After the structure was completed, a 2 inch water-line with a water faucet was installed on the right upstream side near the boat ramp by Don Burgess, a local resident. The faucet was provided for clean-up purposes for the convenience of the local residents. This information was obtained on the day of inspection from a trustee, Mr. Goodson and one of the maintenance personnel, Mr. D. Simpson of Woodridge.

h. Normal Operational Procedures

The dam was built to impound water for recreational use. The lake is privately owned and operated by the residents of Woodridge. The water level is controlled by rainfall, runoff, evaporation and the 36 inch drop inlet pipe. The inspection team is not aware of any operational or water level records for Woodridge Lake.

1.3 Pertinent Data*

a. Drainage Area (square miles):	0.66
b. Discharge at Damsite	
Estimated experienced maximum flood (cfs):	10
Estimated ungated spillway capacity at maximum pool elevation (cfs):	203
c. Elevation (Feet above MSL)	
Top of dam:	821.0
Spillway crest:	
Service Spillway	814.0
Emergency Spillway	819.6
Normal Pool	814.0
Maximum Pool (PMF):	823.14
d. Reservoir	
Length of maximum pool: (Feet)	2745
e. Storage (Acre-Feet)	
Top of dam:	740
Spillway crest:	
Service Spillway	533
Emergency Spillway	694
Normal Pool:	533
Maximum Pool (PMF):	740
f. Reservoir Surface (Acres)	
Top of dam:	35
Spillway crest:	
Service Spillway	26
Emergency Spillway	32 ±

Normal Pool:	26
Maximum Pool (PMF):	36

g. Dam

Type:	Rolled Earthfill
Length:	485 feet
Structural Height:	63.5 feet
Hydraulic Height:	58.5 feet
Top width:	25.0 feet
Side slopes:	
Downstream	1V to 2.75H
Upstream	1V to 3.00H (As shown on design drawings)
Zoning:	Drawings show a "Clay Core" with undefined materials upstream and downstream of the core.
Impervious core:	"Clay Core" has a top width of 20 feet and a bottom width of 50 feet, located at the upstream edge of the dam crest.
Cutoff:	Drawings show a clay cutoff trench with a 20 foot bottom width, a 50 foot top width, a typical depth of 5 feet, and side slopes of 1V to 3H.
Grout curtain:	None

h. Diversion and Regulating Tunnel — None

i. Spillway

Type:	
Service Spillway	Drop inlet
Emergency Spillway	Open channel
Length of weir:	

Service Spillway	3-foot diameter drop inlet pipe
Emergency Spillway	74 feet (top width of V-shaped channel at top of dam elevation)
Crest Elevation (feet above MSL):	
Service Spillway	814
Emergency Spillway	819.6
j. Regulating Outlets	NONE

* In this section maximum pool refers to top of dam elevation, unless otherwise specified.

SECTION 2 : ENGINEERING DATA

2.1 Design

A limited set of drawings for Woodridge Lake Dam have been made available from the engineering firm of Stolwyk, McDaniel, Ferrenbach of Clayton, Missouri. This firm has designed several dams in the central Missouri area. The local Soil Conservation Office in Warrenton has no records for this impoundment.

2.2 Construction

According to the owners, the dam has been constructed of native clay. The contractor for the dam was Norvell Construction of St. Louis, Missouri. The only construction data available was that received from the engineer and is included in this report.

2.3 Operation

The only record of operation for the lake and dam was obtained verbally from one of the trustees of Woodridge. Normal operation is to allow the lake to remain as full as possible while being controlled by rainfall, runoff, evaporation, and the drop inlet structure.

2.4 Evaluation

a. Availability

The only available data for the project includes two drawings. No pertinent data was available for review of hydrology, spillway capacity, flood routing through the reservoir, outlet capacity, slope stabiity, seepage analysis, or foundation conditions.

b. Adequacy

The available engineering data is inadequate to aid in evaluating the hydraulic and hydrologic capabilities and stability of the dam for Phase I investigations.

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

The data given on the available drawings appears to describe the constructed embankment and spillways. The drawings give few details for the dam and appurtenant structures.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Woodridge Lake Dam was made on May 16, 1979. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Dr. M.A. Samad	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Jon Diebel	Engineering Consultants, Inc.	Structural and Mechanical
Peter Strauss	Engineering Consultants, Inc.	Soils
Peter Howard	Engineering Consultants, Inc.	Geology
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural

Specific observations are discussed below.

b. Dam

A water pipe is located on the upstream face of the dam near the right abutment. A representative of the owner reported that the 2 inch diameter pipeline travels parallel to the roadway and is buried about 3-4 feet deep in the upstream face.

The shoreline shows much scalloping and subsequent sloughing from wave action. Where the embankment is scalloped a 1 1/2 to 3 foot high scrap is seen. The steepened angle of the scrap can be seen sloughing back to its angle of repose.

Numerous small erosion gullies exist on the downstream face. A drainage gulley exists in the natural ground close to the downstream right abutment contact. At present there is no danger to the embankment.

A drainage gulley at the downstream left abutment contact is eroding both embankment material and natural ground. This gulley extends from the dam crest to the toe. This gulley ranges from 2-5 feet wide and from 3-4 feet deep. The side walls are nearly vertical and are sloughing.

The crest and the downstream slope of the embankment appears to be in good condition. The crest appears to be adequately protected and the downstream embankment slope is an even slope with a good vegetative cover. No rodent activity was observed on the embankment.

The rocks underlying the dam are cherty limestones and dolomite limestones of Mississippian age (Osagean). These rocks are resting unconformably on Kinderhovkian rocks (Chouteau Formation) and the contact between the rocks is about one mile south of the damsite. These rocks are exposed near both abutments of the dam. The beds are dipping very gently to the northwest. This apparent swing in dip from the regional dip to the northeast may be related to the Warren County anticline 4 1/2 miles to the north.

The Soil Conservation Service (Soil Survey of Montgomery and Warren Counties, Missouri, 1978) reports the soils forming the bottom land at the damsite are composed of silty sands (SM) and silty gravels (GM). The upslope soils consist of silty gravel (GM, GC) low on the slope and silty clay (CL-ML), sandy clay (CL,SC) and clay (CH, MH) higher up.

The carbonate of the Osagean series (Mississippian) are flat lying competant rocks and are suitable for a dam foundation. No serious fault or shear zones are known to exist in the vicinity of the dam. Ideally potential solution channels, such as joints, should be blanketed upstream of the toe and abutments. It is not known how the placement of the fill at the base and abutments of the dam was done. However, there is no indication of leakage at the abutments.

c. Appurtenant Structures

(1) Spillway

The service spillway pipe appeared to be in satisfactory condition. The intake end, with anti-vortex plate and trashrack, and the discharge end of the pipe are both in good condition. The discharge end of the pipe was not constructed with a headwall, and the embankment material is beginning to erode under the pipe. It appears that this undercutting of the pipe will continue until protection is provided for the material at this location. A small pool has formed downstream of the discharge end of the spillway pipe. This pool will not drain in its current condition.

The general condition of the emergency spillway is satisfactory. However, it appears that discharges through the spillway will flow down the left abutment contact. Some erosion gullies having a maximum size of 3 feet deep by 3 feet wide have formed along the abutment contact at this time. Discharges through the spillway flow into a slough area which has formed downstream of the toe of the dam. This area is marshy and filled with cattails and other phreatophyte.

(2) Outlet Works

There is no operating outlet pipe or low level drain pipe at the dam.

d. Reservoir Area

The water surface elevation was 814 feet above MSL at the time of inspection.

The reservoir rim is gently to moderately sloping with trees and woods near the slope. No evidence of any instability was observed.

e. Downstream Channel

The downstream channel is well defined with some vegetative and tree growth about 100 feet downstream from the spillway discharge area. No major obstacles or debris were observed along the downstream channel. Only minor erosion could be observed in a few areas.

3.2 Evaluation

The following problems were observed which could affect the safety of the dam or which will require maintenance within a reasonable period of time.

1. Deep erosion gulley along downstream left abutment contact, and erosion gullies at the right abutment contact.

2. Wave erosion on the upstream embankment slope.

3. Poorly channelized exit for the emergency spillway discharges which causes ponded water at downstream toe and erosion along the left abutment contact.

4. Undercutting on the discharge end of the service spillway pipe, and the ponded water found downstream of this pipe.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

There are no set operational procedures for Woodridge Lake Dam. As mentioned in Section 2, the lake is allowed to remain as full as possible as a result of the natural phenomena of rainfall, evaporation, runoff and the drop inlet structure discharge.

4.2 Maintenance of Dam

Woodridge Lake Dam is maintained by the resident trustees and several land owners around the lake. Since the structure is fairly new, no trees or shrubs were noticed on either slope.

There is a two lane gravel road along the crest of the dam which provides satisfactory protection for the crest.

The upstream slope seems to be slightly eroded near the water surface. There is no riprap in this area. There are erosion gullies forming at each abutment on the downstream side near the emergency spillway. This erosion should be arrested before it is allowed to erode the embankment material.

Financial records are kept by the trustees regarding maintenance but no physical records were available for this report.

4.3 Maintenance of Operating Facilities

The only facility at the damsite which requires any attention is the 36 inch steel pipe drop inlet structure. There are no gates or valves associated with this spillway and the trash rack is a series of bars which are welded to the top of the pipe below the anti-vortex plate.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in use at the dam site.

4.5 Evaluation

The operation and maintenance for Woodridge Lake Dam seems to be adequate. The trustees and local maintenance personnel live in close proximity to the dam and its surrounding areas.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Woodridge Lake Dam upstream from the dam axis consists of approximately 420 acres. Most of the watershed area is wooded and covered with grass. Land gradients in the higher regions of the watershed average roughly 8 percent, and in the lower areas surrounding the reservoir average about 4 percent. The Woodridge Lake Reservoir is located on an unnamed tributary of Dry Creek. The reservoir is about 1000 feet upstream from the confluence of the unnamed tributary and Dry Creek. At its longest arm the watershed is approximately 1 1/4 mile long. A drainage map showing the watershed area is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Woodridge Lake Dam was based on criteria set forth in the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS method was used for deriving the unit hydrograph, utilizing the Corps of

Engineers' computer program HEC-1, (Dam Safety Version). The unit hydrograph parameters are presented in Appendix B. The SCS method was also used for determining loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are also presented in Appendix B. The curve number, the unit hydrograph parameters, the PMP index rainfall and the percentages for various durations were directly input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak discharges of the PMF and one-half of the PMF are 7143 cfs and 3571 cfs respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method also utilizing the HEC-1 (Dam Safety Version) computer program. The reservoir was assumed at the spillway crest level at the start of routing computation. The peak outflow discharges for the PMF and one-half of the PMF are 5259 and 2325 cfs respectively. Both the PMF and one-half of the PMF, when routed through the reservoir results in overtopping of the dam.

The stage-outflow relation for the spillway was prepared from field notes, and sketches, prepared during the field inspection. The reservoir stage-capacity data were based on the U.S.G.S Warrenton Quandrangle topographic map (7.5 minute series). The spillway and overtop rating curve and the reservoir capacity curve are presented in Plates 2 & 3 respectively in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest will erode the dam embankment and release all the stored water into the downstream floodplain. The safe hydrologic design of a dam requires a spillway discharge capability, in combination with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineer designs its dams to safely pass the Probable Maximum Flood that is estimated could be generated from the upstream watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. According to the Corps criteria, the hydrologic requirement for safety for this dam is the capability to pass the Probable Maximum Flood without overtopping.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to the representative of owner, the maximum reservoir level was about 6 inches above the crest of the service spillway.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1c(1) and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1-a, both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The peak outflow discharges for the PMF and one-half of the PMF are 5259 and 2325 cfs respectively. The PMF overtopped the dam crest 2.14 feet and one-half of the PMF overtopped the dam crest by 1.05 feet. The total duration of embankment overflow is 6.00 hours during the PMF, and 3.42 hours during one-half of the PMF. The spillway for Woodridge Lake Dam is capable of passing a flood equal to approximately 27 percent of the PMF just before overtopping the dam.

The computed one percent chance flood using 100-year, 24 hour rainfall data was routed through the reservoir, and is given in the last section in Appendix B. The routing results indicate the reservoir/spillway system will accomodate the 100-year flood without overtopping the dam.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately 5-1/2 miles downstream of the dam. Within this zone, eleven dwellings and seven outbuildings may be found.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The wave action on the upstream slope of the embankment is causing substantial erosion and sloughing of embankment materials. Further erosion to the slope will decrease the embankment section, reducing its structural stability. This condition should be repaired by stabilization of the slope.

The erosion gullies on the abutment contacts also are removing parts of the embankment. These should be repaired to prevent the removal of additional embankment material.

The route of discharges through the emergency spillway threatens the structural integrity of the embankment. During a flood situation flows through the spillway could potentially erode a substantial amount of the embankment. This condition must be remedied by channelization of the route of the spillway discharges away from the embankment.

The undercutting of the material surrounding the service spillway pipe should be stopped by stabilization of the surrounding materials. Furthermore, the pond downstream of the spillway pipe should be drained by cutting a channel downstream of the pond to drain the standing water. The marshy area to the left of the spillway pipe is also undesir-

able, but will remain as long as spillway discharges through the emergency spillway flow along the abutment contact to the toe of the dam. Following channelization of the emergency spillway channel away from the embankment, this area should be filled with compacted earthfill such that a positive slope will exist into the streambed downstream of the dam.

No signs of settlement or distress were observed on the downstream slope of the dam or in the foundation. Seepage was not observed on the embankment or downstream of the toe of the embankment. The standing water and marshy areas are thought to be from surface drainage or spillway discharges.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam or appurtenant structures were found.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. Water levels have not been recorded, however, the reservoir was almost full on the day of inspection, and is assumed to be close to full at all times.

d. Post Construction Changes

No post construction changes are known to exist which will affect the structural stability of the dam.

e. Seismic Stability

According to the Seismic Zone Map of Contiguous States, Form TM 5-809-10/NAVFAC P-355/AFM 88-3 Chapter 13; April 1979, the portion of Missouri in which Woodridge Lake Dam is located is in Seismic Zone 2. The engineer performing the stability analysis on the embankment shall determine the necessity of a seismic analysis for this embankment.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Woodridge Lake Dam was found to be "Seriously Inadequate". The spillway/reservoir system will accomodate only 27 percent of the PMF without overtopping the dam. The spillway and the reservoir will accomodate the 100-year flood without overtopping the dam.

The dam is overtopped over two feet during the PMF and the duration of embankment overflow is six hours. If the body of the dam is made up of silty soils, overtopping could result in dam failure.

Several conditions exist at Woodridge Lake Dam which can jeopardize the safety of the structure. The sloughing and eroding of the embankment materials on the upstream embankment slope is a potentially dangerous condition. The slope should be stabilized by either flattening of the embankment slope or by the addition of rock riprap to the embankment slope.

The handling of surface drainage and spillway discharges are causing structural problems at the damsite. Erosion gullies are present at both abutment contacts. These should be repaired, and future erosion prevented by proper grading at the abutments of the dam.

The left abutment contact is being further damaged by flows through the emergency spillway. This condition should be remedied by channelizing the discharges through the spillway away from the embankment. Following this work, the marshy condition and ponds at the downstream toe of the embankment should be drained and filled with compacted earthfill.

The dam has no available stability or seepage analysis. To assure that conventional stability safety factors are comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" exist, stability analyses should be made.

b. Adequacy of Information

Adequate information concerning the dam and appurtenant structures is not available. No seepage and stability analyses were available for review.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished in the near future. The items recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken as soon as possible, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternative:

1. Spillway capacity and/or height of the dam should be increased to accomodate the PMF without overtopping the dam.

b. O & M Procedures:

1. Stabilize the upstream embankment slope to prevent future sloughing and erosion due to wave action.

2. Channelize the emergency spillway discharge channel to prevent discharges through the spillway from flowing along the left abutment contact of the dam.

3. Repair the erosion gullies at the abutment contacts, and prevent further erosion by proper grading of the abutments of the dam.

4. Stabilize the material surrounding the downstream end of the service spillway pipe by the addition of a concrete headwall on the end of the pipe or rock riprap on the slope.

5. Drain the pond downstream of the service spillway pipe, and fill the marshy area to the left of this pipe with compacted earth.

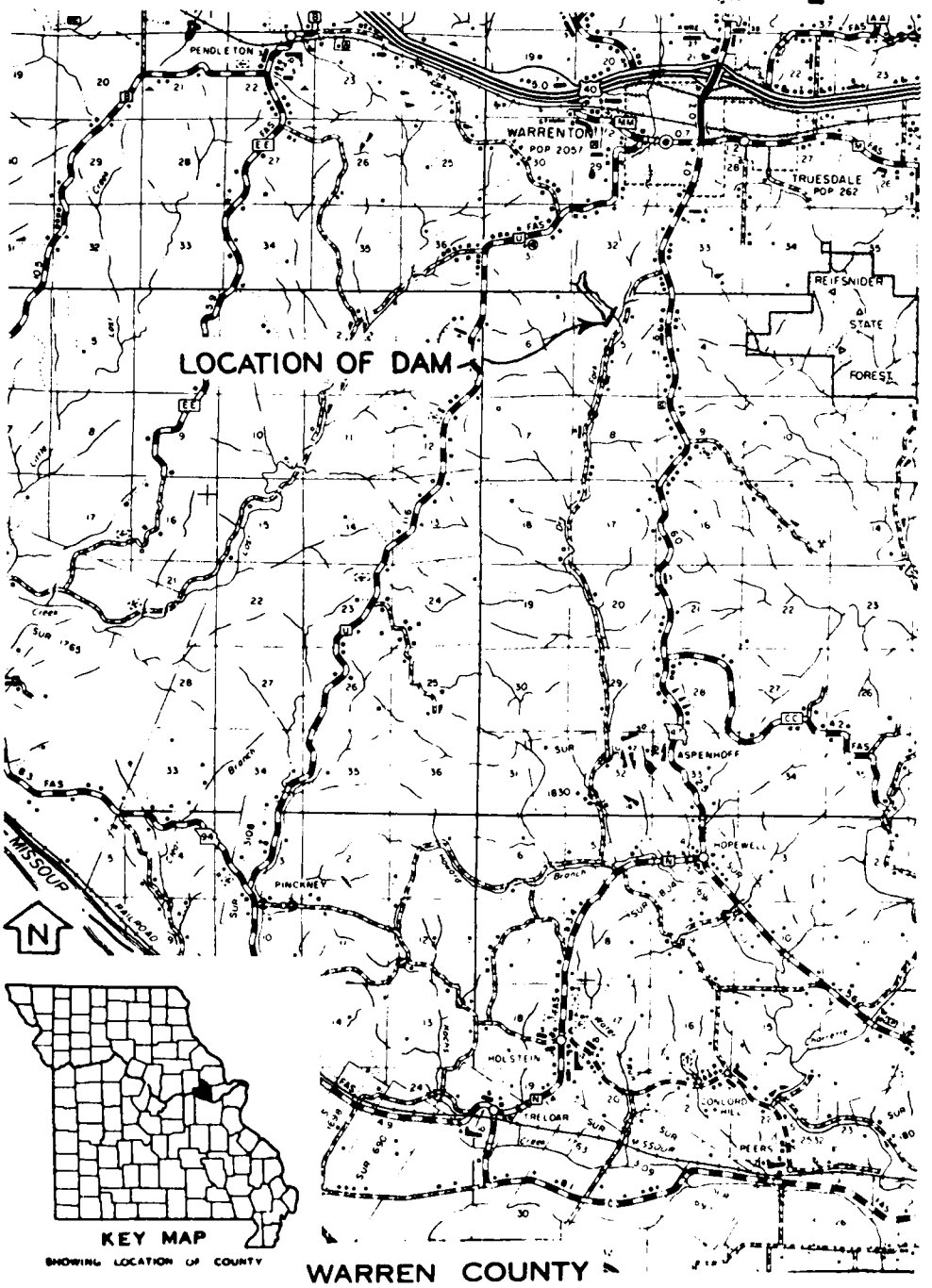
6. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

7. The owner should initiate the following programs.

   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

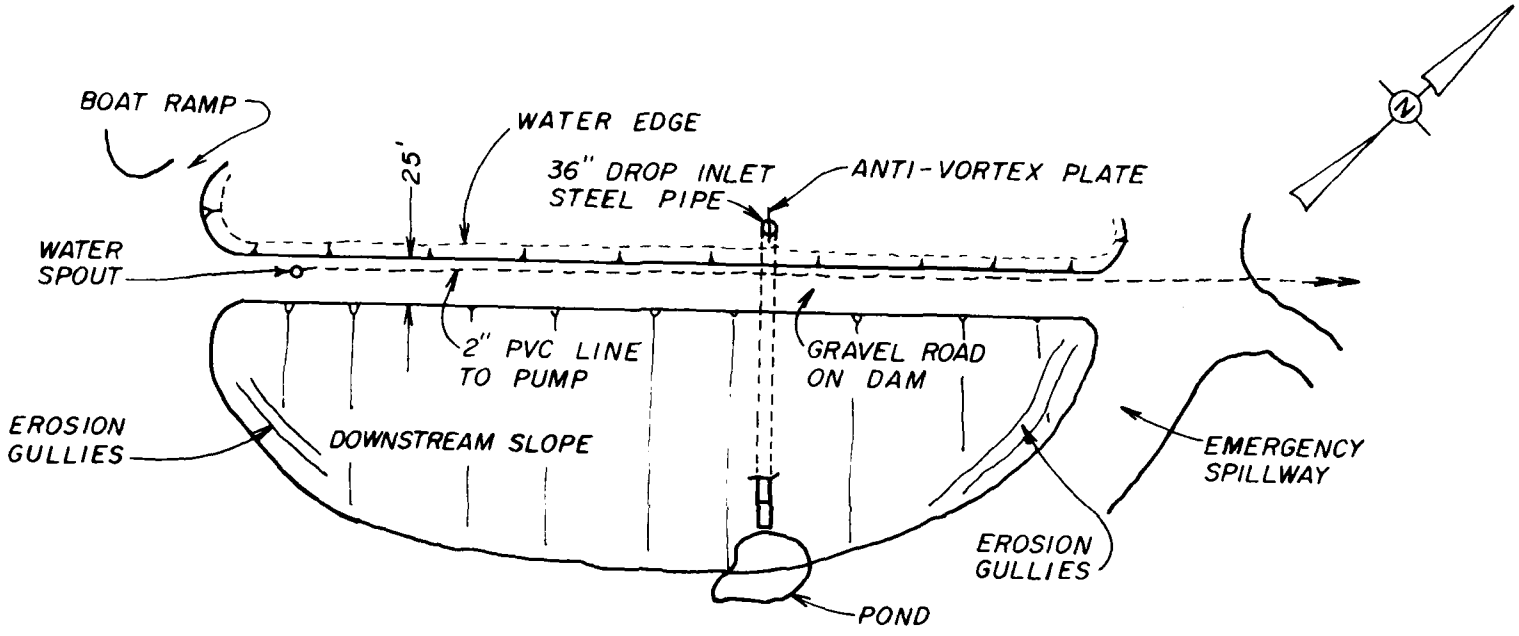
   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

PLATES

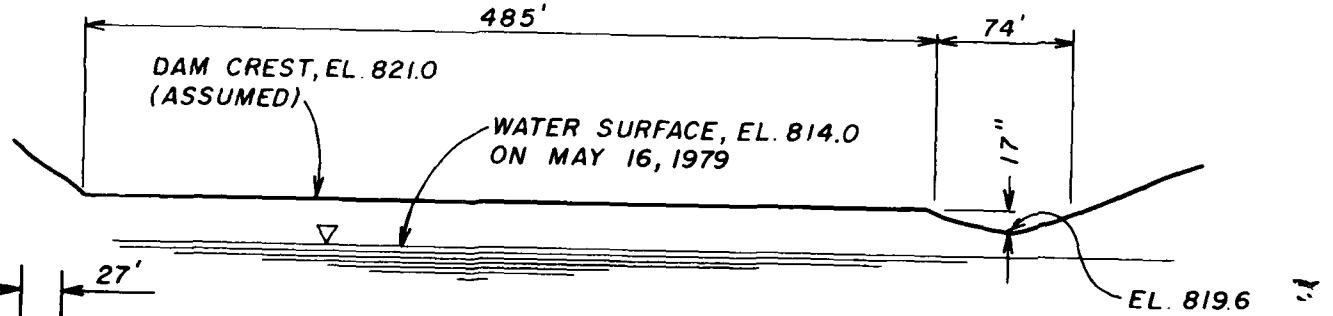


LOCATION MAP - WOODRIDGE LAKE DAM

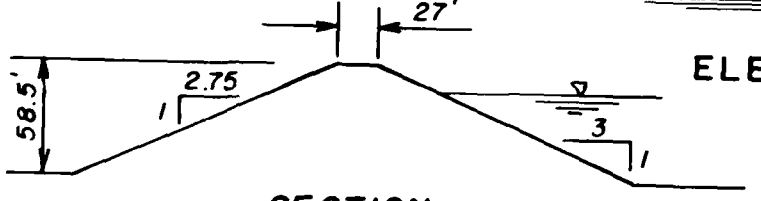
WOODRIDGE LAKE DAM (MO. 11005)
PLAN, ELEVATION & SECTION



PLAN

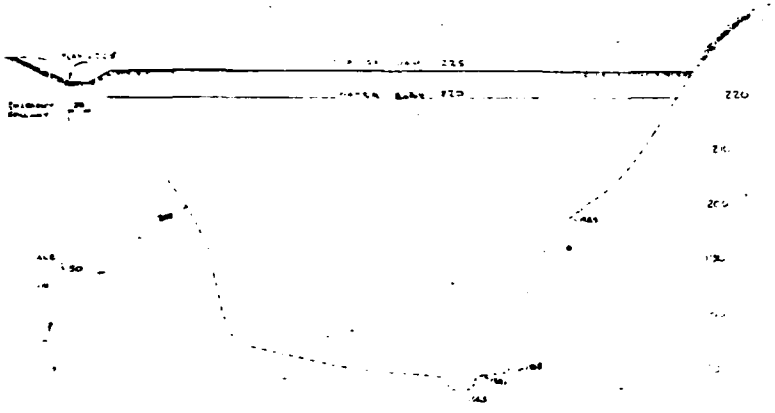


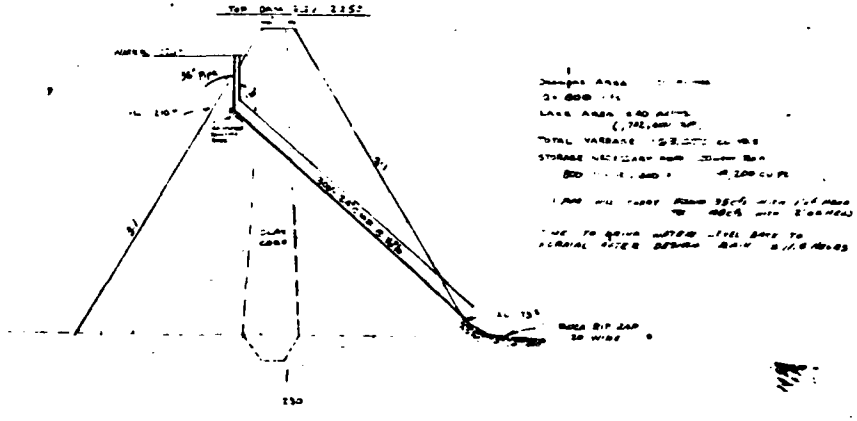
ELEVATION



SECTION

SCALE:
1" = 100' (HORIZONTAL)
VERTICAL NOT TO SCALE



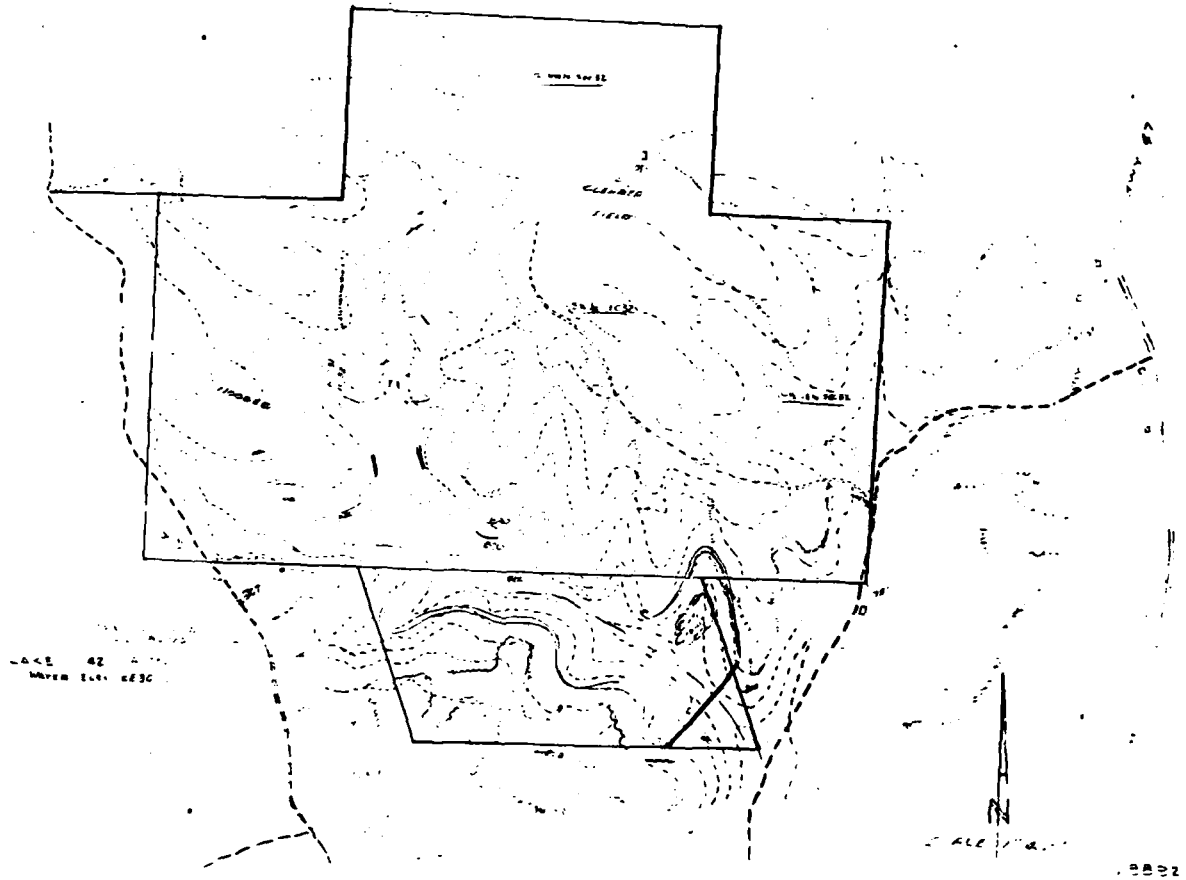


WOODRIDGE

WARRENTON MISSOURI

EDWARD H GIVENS
760 ST FRANCOIS
FLORISSANT, MO
TEI-1800

AF 4C+47A R2W
SECTIONS 5, 31, 32
WARREN CO MO.



DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Woodridge Lake Dam (Mo. 11005) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Woodridge Lake Dam (Mo. 11005).

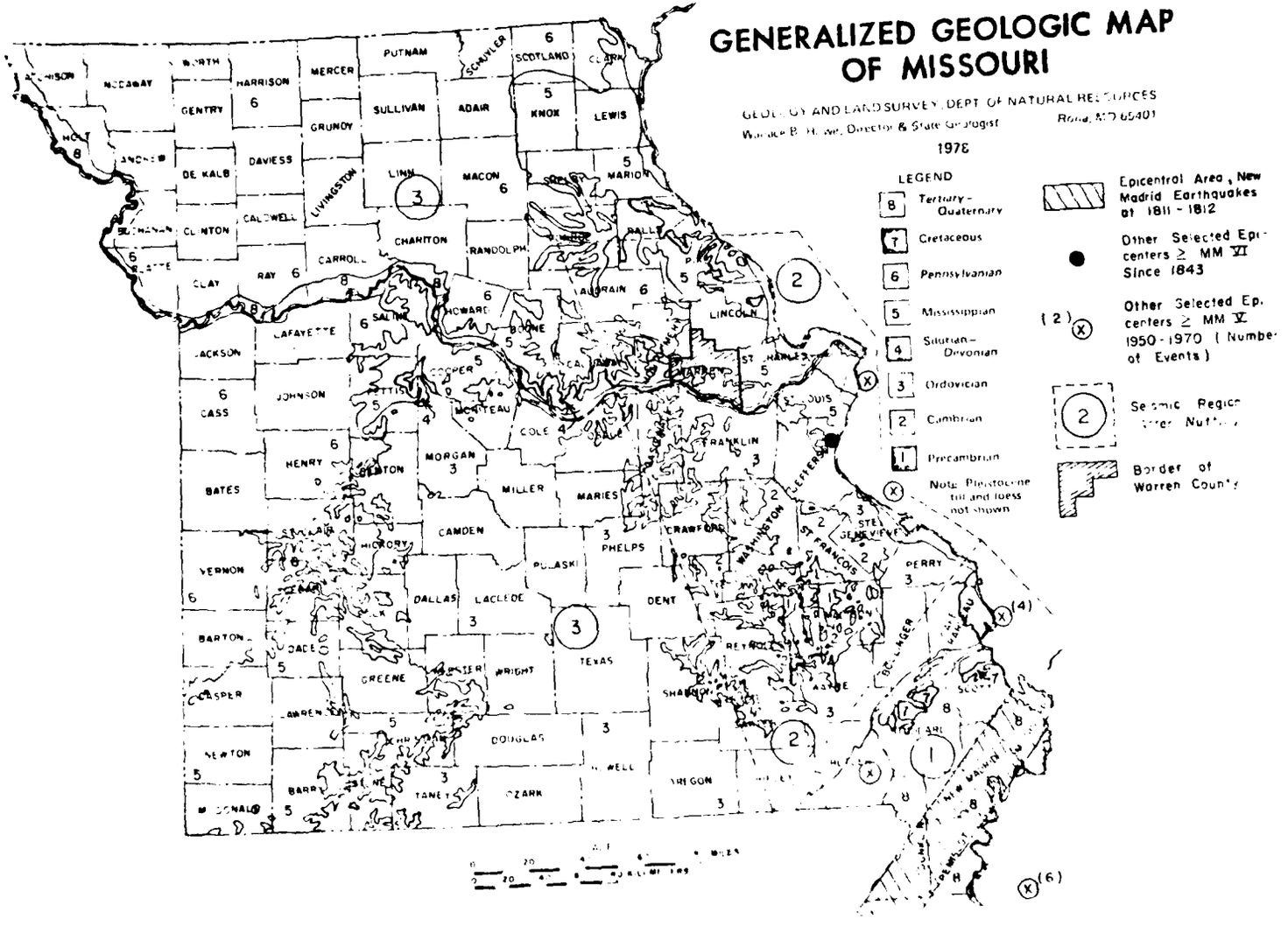
It was prepared under the National Program of Inspection of Non-Federal Dams.

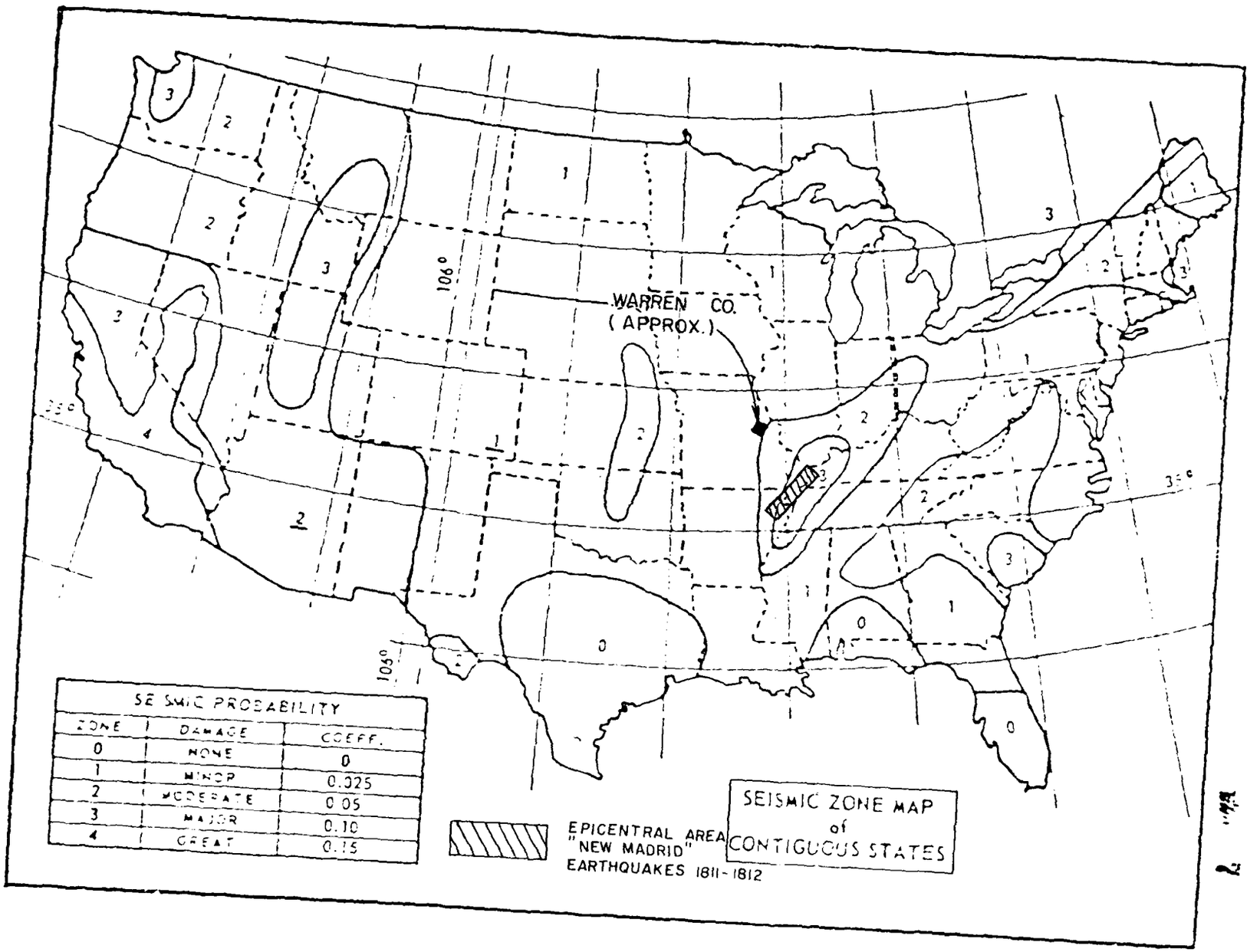
This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: _____ _____
Chief, Engineering Division Date

APPROVED BY: _____ _____
Colonel, CE, District Engineer Date


GENERALIZED GEOLOGIC MAP
OF MISSOURI
GEOLOGY AND LAND SURVEY, DEPT. OF NATURAL RESOURCES
Rolla, MO 65401
1976
LEGEND
8 Tertiary – Quaternary
7 Cretaceous
6 Pennsylvanian
5 Mississippian
4 Silurian – Devonian
3 Ordovician
2 Cambrian
1 Precambrian
Note: Pleistocene till and loess not shown
Epicentral Area, New Madrid Earthquakes at 1811 - 1812
Other Selected Epicenters ≥ MM VI Since 1843
(2) Other Selected Epicenters ≥ MM V 1950 - 1970 (Number of Events)
2 Seismic Region (Number)
Border of Warren County
PUTNAM
SCHUYLER
SCOTLAND
CLARK
HARRISON
MERCER
GENTRY
GRUNDY
SULLIVAN
ADAIR
KNOX
LEWIS
ATCHISON
NODAWAY
WORTH
HOLT
ANDREW
DE KALB
DAVIESS
LIVINGSTON
LINN
MACON
SHELBY
MARION
BUCHANAN
CLINTON
CALDWELL
CHARITON
RANDOLPH
PIKE
PLATTE
CLAY
RAY
CARROLL
SALINE
HOWARD
BOONE
AUDRAIN
LINCOLN
LAFAYETTE
JACKSON
JOHNSON
COOPER
CALLAWAY
MONTGOMERY
WARREN
ST. LOUIS
CASS
HENRY
MORGAN
COLE
FRANKLIN
JEFFERSON
BATES
BENTON
MILLER
MARIES
CRAWFORD
WASHINGTON
ST. FRANCOIS
STE. GENEVIEVE
PERRY
CAMDEN
HICKORY
PHELPS
PULASKI
VERNON
DALLAS
LACLEDE
DENT
BARTON
CEDAR
GREENE
WEBSTER
WRIGHT
TEXAS
SHANNON
BOLLINGER
CAPE GIRARDEAU
CRAWFORD
STODDARD
NEWTON
LAWRENCE
DOUGLAS
WELLS
OREGON
MCDONALD
BARRY
STONE
TANEY
OZARK
(4)
(6)


WARREN CO.
(APPROX.)
106°
105°
35°
SEISMIC PROBABILITY
ZONE | DAMAGE | COEFF.
0 | NONE | 0
1 | MINOR | 0.025
2 | MODERATE | 0.05
3 | MAJOR | 0.10
4 | GREAT | 0.15
EPICENTRAL AREA "NEW MADRID" EARTHQUAKES 1811-1812
SEISMIC ZONE MAP of CONTIGUOUS STATES

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

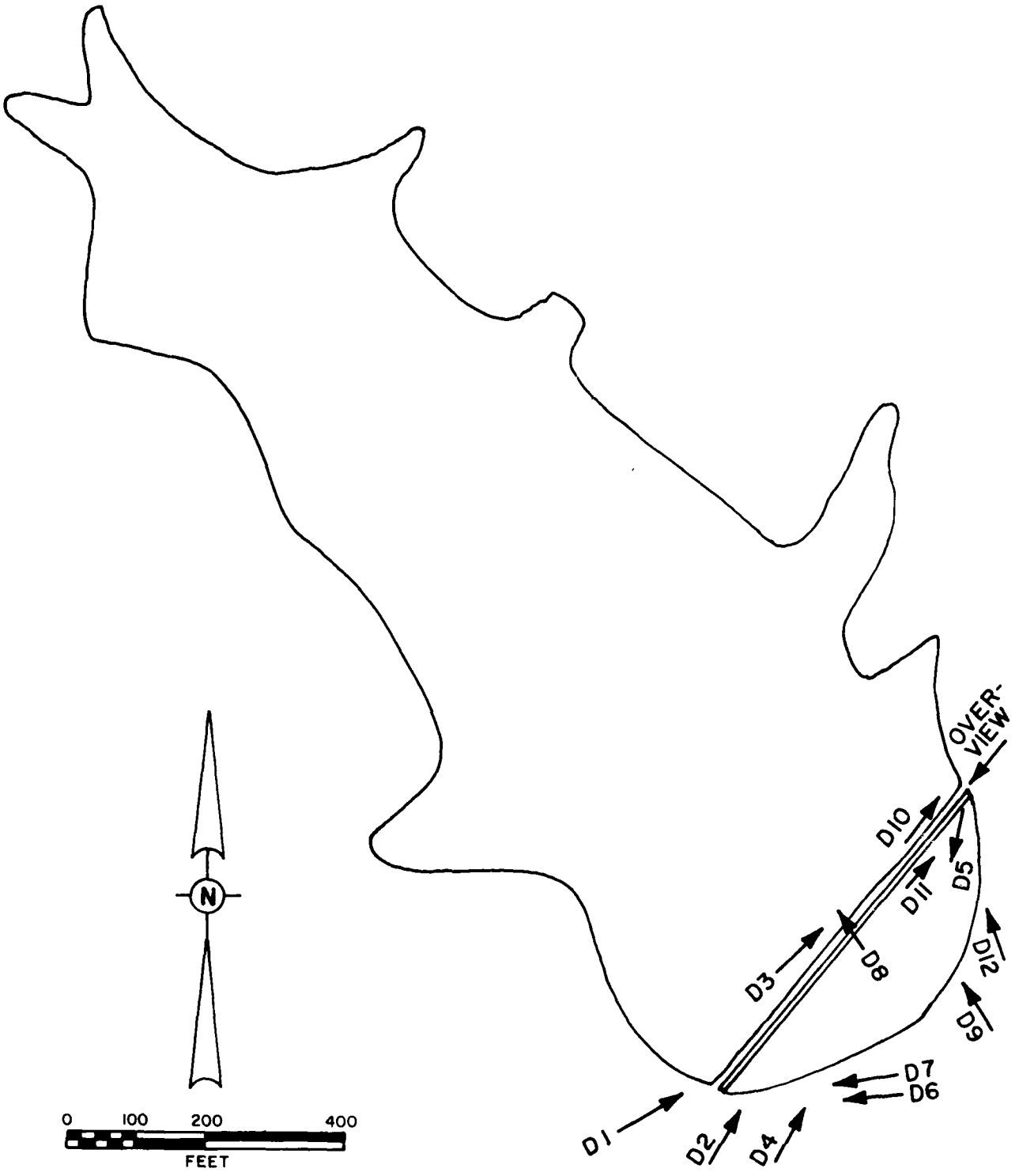


PHOTO INDEX
FOR
WOODRIDGE LAKE DAM

WOODRIDGE LAKE DAM

D1 - Upstream Embankment Slope

D2 - Downstream Embankment Slope

D3 - Sloughing on Upstream Embankment Slope

D4 - View Dosntream of Dam

D5 - View Dosntream of Dam

D6 - Erosion at Right Abutment Contact

D7 - Erosion at Left Abutment Contact

D8 - Service Spillway Intake

D9 - Service Spillway Discharge

D10 - Emergency Spillway

D11 - Emergency Spillway

D12 - Left Abutment Contact

D1

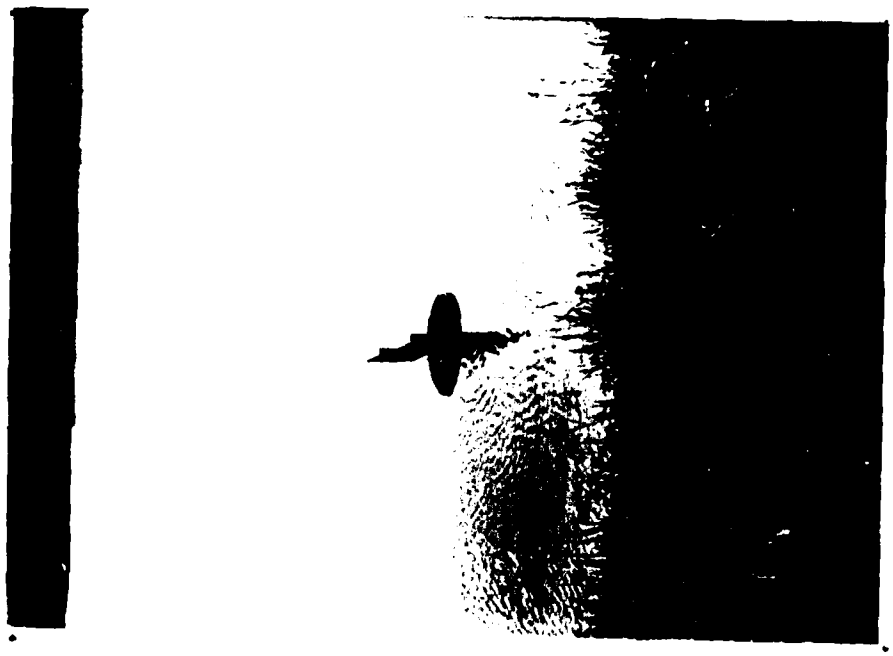
D2

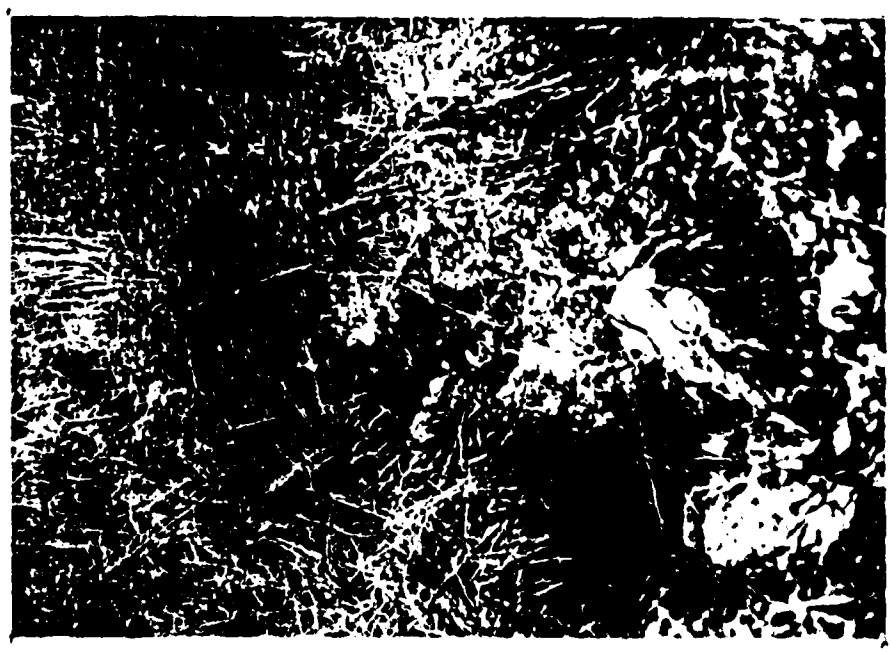
D3

D4

D5

D6

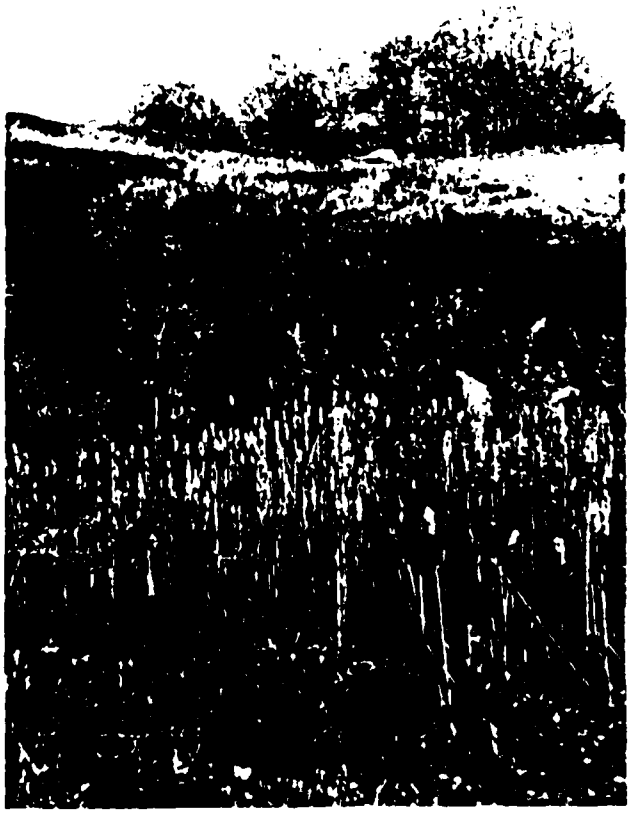




D9

D10

D11

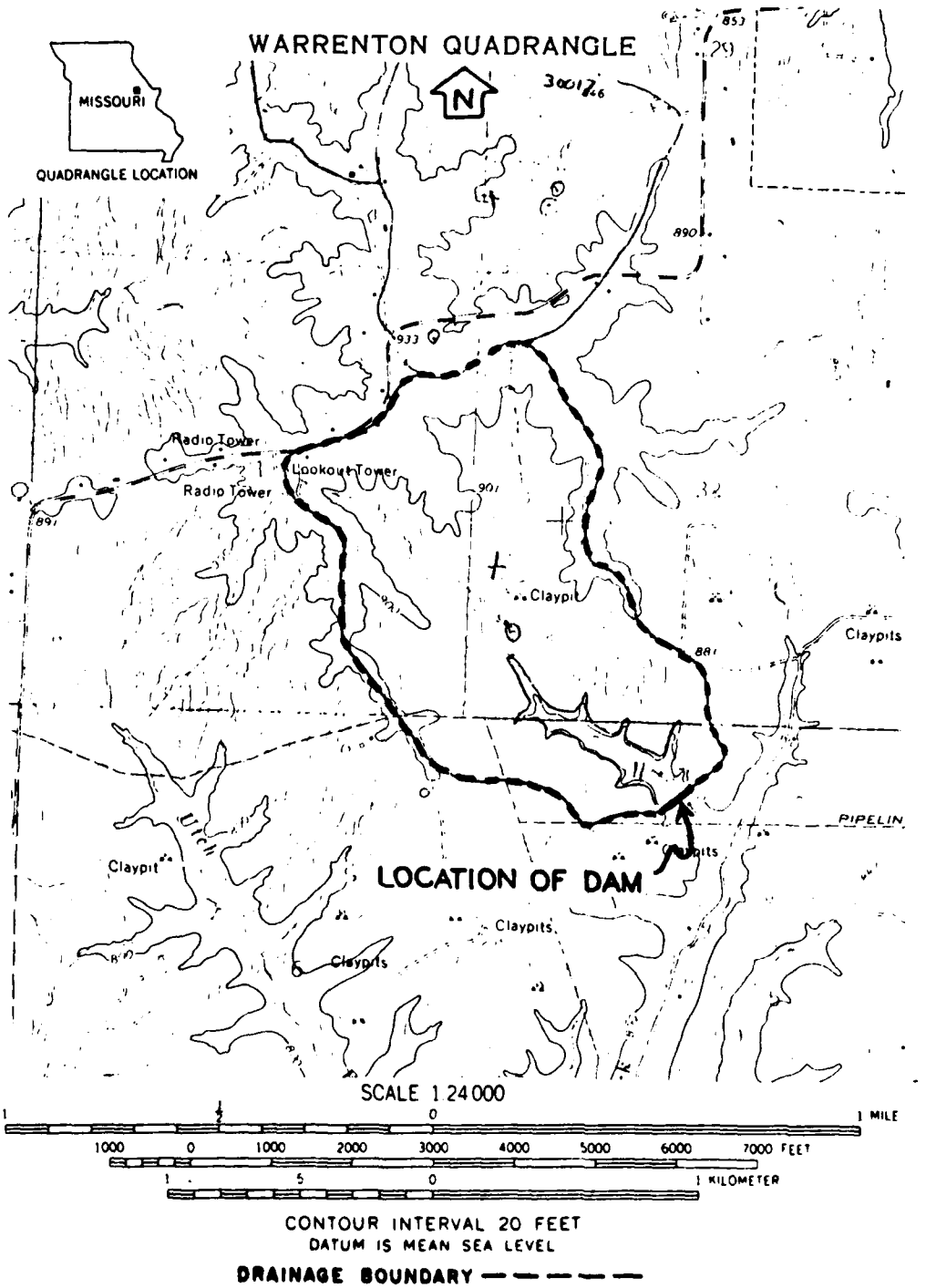


D12

APPENDIX B

HYDROLOGIC COMPUTATIONS

PLATE-1, APPENDIX-B



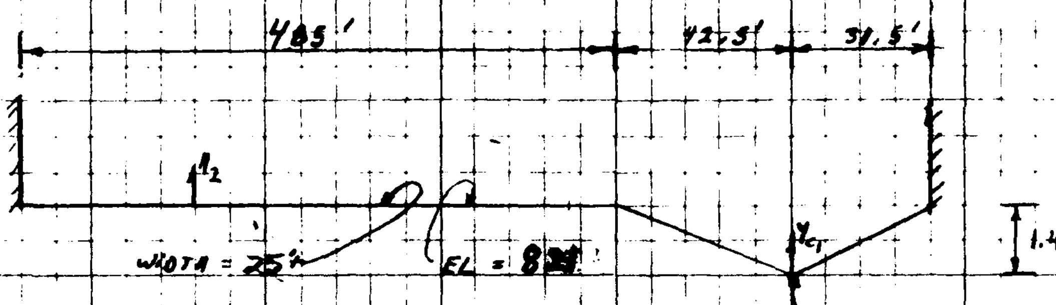
WOODRIDGE LAKE DAM (MO. 11005)
DRAINAGE BASIN

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF

MISSOURI DAM 11005 — JOB NO. 1240-001-1

OVERTOP DISCHARGE RATING CURVE — BY KLB / M.R.H. — DATE 5-21-79



CRITICAL DEPTH ASSUMED IN SPILLWAY SECTION

Y_{c_1} (Ft)	A_{c_1} (Ft²)	T_{c_1} (Ft)	$V_{c_1} = 5.67\sqrt{\frac{A_{c_1}}{T_{c_1}}}$	$\frac{V_{c_1}^2}{2g}$	$Q_{c_1} = A_{c_1}V_{c_1}$ (CFS)	U/S W.S. = 819.6 + $\frac{V_{c_1}^2}{2g} + Y_{c_1}$	H_2	C_2	L_2	$Q_2 = C_2 L_2 H_2^{3/2}$	$Q_T = Q_{c_1} + Q_2$
0	0	0	0	0	0	819.6	–	–	–	–	0
1	26.06	52.11	4.01	.25	104.49	820.85	–	–	–	–	104.49
1.42	52.54	74	4.78	.35	251.14	821.37	.37	2.70	485	294.72	545.85
2.5	132.46	74	7.59	.89	1004.83	822.99	1.99	2.63	485	3580.78	4585.61
3.5	206.46	74	9.47	1.39	1955.3	824.49	3.49	2.63	485	8316.4	10,271.70

ECI-4 ENGINEERING CONSULTANTS, INC.

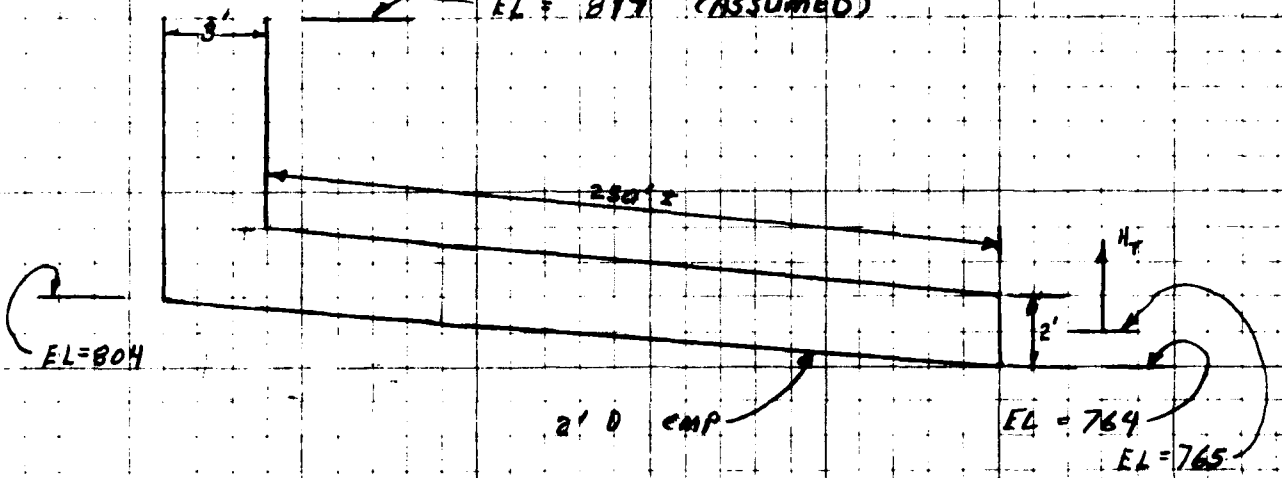
DAM SAFETY INSPECTION - Missouri SHEET NO. 1 OF

MISSOURI DAM 11005 JOB NO. 1240-001-1

DROP INLET SPILLWAY RATING CURVE BY KLB DATE 5-23-79

M.P.H. ✓

DROP INLET SPILLWAY



SPILLWAY DISCHARGE (ASSUME NO TAIL WATER EFFECT)

AT WL. 814.5: $H_T = 814.5 - 814 = 0.5$

a) WEIR FLOW:

ASSUME $C = 3.03$

$Q = CLH^{3/2} = 3.03 \times (11 \times 3) \times 0.5^{3/2}$

$= 10.10$ CFS

b) PERMISSABLE FLOW THROUGH THE PIPE.

SLOPE OF THE PIPE = $S = \frac{804 - 764}{250}$

$S = \frac{40'}{250} = 0.160$ Ft/Ft

b) CRITICAL SLOPE

$$z = \frac{Q}{\sqrt{T}} = \frac{10.10}{\sqrt{32.2}} = 1.78$$

$$\frac{z}{d_o^{2.5}} = \frac{1.78}{2^{2.5}} = 0.81$$

FOR $\frac{z}{d_o^{2.5}} = 0.81$, $\frac{Y_c}{d_o} = 0.56 \Rightarrow Y_c = 1.12'$

$$S_c = \left(\frac{Q \cdot n}{1.49 A R^{2/3}}\right)^2$$

ASSUME $n = 0.014$

$\frac{Y_c}{d_o} = 0.56 \Rightarrow \frac{A}{A_o} = 0.58$ & $\frac{R}{R_o} = 1.07$

WHERE $A_o = \frac{\pi}{4} d_o^2 = 0.7854 \times 2^2$

$= 3.14^{\square'}$

$R_o = 0.25 d_o = 0.25 \times 2 = 0.50'$

$\therefore$

$A = 0.58 \times 3.14 = 1.82^{\square'}$

$R = 1.07 \times 0.50 = 0.54'$

$\therefore S_c = \left(\frac{10.10 \times 0.014}{1.49 \times 1.82 \times 0.54^{2/3}}\right)^2$

$= 0.006 << S$, $\Rightarrow$ PIPE SLOPE IS SUPER CRITICAL

$\therefore$ CONTROL IS CRITICAL DEPTH AT WEIR

AND $\boxed{Q = 10.10 \text{ CFS}}$

EC1-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 3 OF
MISSOURI DAM 11006 — JOB NO. 1240-001-1
SPILLWAY RATING CURVE. — BY KLB DATE 5-23-79

WL AT 815:

a) WEIR FLOW

$$Q = CLH^{3/2} = 3.03 \times (11 \times 3) \times 1^{3/2} = 28.56 \text{ CFS.}$$

b) PERMISSIBLE DISCHARGE THROUGH PIPE

$$Z = \frac{Q}{\sqrt{g}} = \frac{28.56}{\sqrt{32.2}} = 5.03$$

$$\frac{Z}{d_o^{2.5}} = \frac{5.03}{2^{2.5}} = 0.89$$

$$\Rightarrow \frac{y_c}{d_o} = 0.92 \Rightarrow y_c = 1.84$$

$$\frac{y_c}{d_o} = 0.92 \Rightarrow \frac{A}{A_o} = 0.96 \text{ \& } \frac{R}{R_o} = 1.18$$

$$A = 0.96 \times \frac{\pi}{4} \times (2^2) = 3.02$$

$$R = \frac{1}{4}(2) \times 1.18 = 0.59$$

$$S_c = \left(\frac{28.56 \times 0.014}{1.49 \times 2.89 \times 0.59^{2/3}}\right)^2 = 0.017 > S = 0.016$$

$\Rightarrow$ SLOPE IS SUPERCRITICAL

$\therefore$ PIPE FLOW IS SUPERCRITICAL AND CONTROL WOULD BE FOR WEIR CONDITIONS IF PRESSURE FLOW DOES NOT OCCUR.

SINCE $y_c = 1.84 \simeq d_o = 2.0$ CHECK FOR PRESSURE FLOW.

c) PRESSURE FLOW.

$$H_T = \left(1 + K_e + f\frac{L}{D}\right)\frac{v^2}{2g}$$

WL AT 815 (CONT.)

c) CHECK PRESSURE FLOW

ASSUME $K_e = 0.10$

& $f = 0.023$ FOR $n = 0.014$

$$H_T = \left(1.0 + 0.10 + 0.023 \frac{250}{2}\right) \frac{V^2}{2g}$$

$$H_T = 3.98 \frac{V^2}{2g}$$

$$V = \sqrt{\frac{2g\,H_T}{3.98}} = 4.02 \sqrt{H_T}$$

$$Q = A \cdot V = \frac{\pi}{4} \times 2^2 \times 4.02 \sqrt{H_T}$$

$$Q = 12.63 \sqrt{H_T}$$

$H_T = 815 - 765 = 50.0$

$Q = 12.63 \sqrt{50} = \underline{89.31}$ CFS > 28.56

∴ AT ELEV 815, WEIR FLOW CONTROLS. USE $\underline{Q = 28.56}$

<u>WL AT 816</u>

a) WEIR FLOW

$$Q = CLH^{3/2} = 3.03 \times (\pi \times 3) \times 2^{3/2}$$

$Q = 80.77$ CFS.

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 5 OF
MISSOURI DAM 11005 JOB NO. 1240-001-1
SPILLWAY RATING CURVE BY KLB M.L.L. ✓ DATE 5-23-79

W.L. AT 816.

b) PERMISSIBLE DISCHARGE IN PIPE

$$Z = \frac{Q}{\sqrt{g}} = \frac{80.77}{\sqrt{32.2}} = 14.23$$

$$\frac{Z}{d_o^{2.5}} = \frac{14.23}{2^{2.5}} = 2.52$$

$$\Rightarrow \frac{y_c}{d_o} = 0.98, \Rightarrow \frac{A}{A_o} = 0.995, \frac{R}{R_o} = 1.09$$

$$\frac{y_c}{d_o} = 0.98 \Rightarrow y_c = 1.96$$

$$A = 0.995 \times \frac{\pi}{4} \times (2^2) = 3.13$$

$$R = \frac{1}{4}(2) \times 1.09 = 0.55$$

$$S_c = \left(\frac{80.77 \times 0.014}{1.49 \times 3.13 \times 0.55^{2/3}}\right)^2 = 0.13 < S = 0.16$$

$\Rightarrow$ SLOPE IS SUPERCRITICAL

SINCE $y_c = 1.96 \approx d_o = 2.0$

CHECK PRESSURE FLOW

c) PRESSURE FLOW

$$Q = 12.63\sqrt{H_t}$$

$$H_t = 816 - 765 = 51$$

$$Q = 12.63\sqrt{51} = 90.20 > 80.77$$

∴ FLOW IS CONTROLLED BY WEIR FLOW AT THE CREST AND $\underline{Q = 80.77}$

WL AT 817

a) WEIR FLOW

$$Q = CLH^{3/2} = 3.03 \times (\pi \times 3) \times 3^{3/2} = 148.39$$

b) PERMISSABLE FLOW IN PIPE.

$$Z = \frac{Q}{\sqrt{g}} = \frac{148.39}{\sqrt{32.2}} = 26.15$$

$$\frac{Z}{d_o^{2.5}} = \frac{26.15}{2^{2.5}} = 4.62$$

$$\Rightarrow \frac{y_c}{d_o} = 0.98, \Rightarrow \frac{A}{A_o} = 0.995, \frac{R}{R_o} = 1.09$$

$$\frac{y_c}{d_o} = 0.98, \Rightarrow y_c = 3.13^{1.96}$$

$$A = 0.995 \times \frac{\pi}{4} \times (2^2) = 3.13$$

$$R = \frac{1}{4}(2) \times 1.09 = 0.55$$

$$S_c = \left(\frac{148.39 \times 0.014}{1.49 \times 3.13 \times 0.55^{2/3}} \right)^2 = 0.44 > S = 0.16$$

SLOPE IN THE PIPE IS NOW SUB-CRITICAL.

CHECK ORIFICE FLOW

c) ORIFICE FLOW

ASSUME $C = 0.62$, $H_T = 817 - 765 = 52$

$$Q = C A \sqrt{2g H_T}$$

$$Q = 0.62 \times \left(\frac{\pi}{4} \times 2^2\right) \times \sqrt{64.4 \times 52}$$

$$Q = 112.72 < 148.39$$

∴ ORIFICE FLOW CONTROLS IF PRESSURE FLOW DOES NOT.

WL AT 817 (CONT)

d) CHECK PRESSURE FLOW.

$$Q = 12.63\sqrt{H_t}$$

$$H_t = 817 - 765 = 52 \text{ Ft}$$

$$Q = 12.63\sqrt{52} = \underline{91.08} < 112.72$$

∴ AT ELEVATION 817 PRESSURE FLOW CONTROLS

$$\underline{Q = 91.08} \text{ CFS}$$

AND FOR ALL ELEVATIONS ABOVE 817 PRESURE FLOW WILL CONTROL THAT IS. USE THE EQUATION $Q = 12.63\sqrt{H_t}$ FOR ALL ELEVATIONS ABOVE 817.

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF

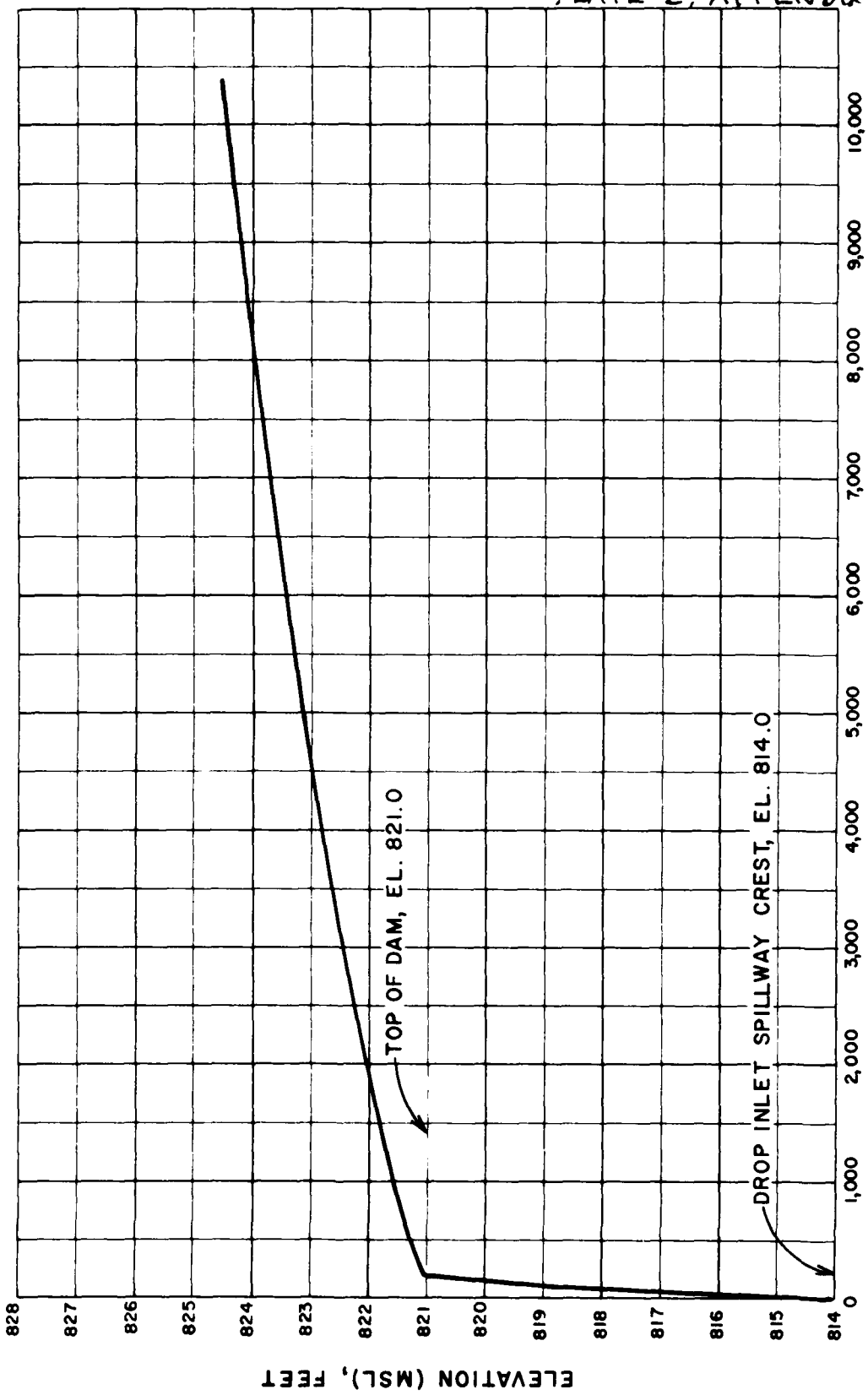
MISSOURI DAM 11005 JOB NO. 1240-001-1

COMBINED SPILLWAY AND OVERTOP RATING CURVES BY KLG DATE 5-23-79
M.R.H.J

RESERVOIR WATER SURFACE ELEV.	HEAD ON DROP INLET SPILLWAY (FT) H_E	DROP INLET SPILLWAY DISCHARGE $Q = 12.63\sqrt{H_E}$	EMERGENCY SPILLWAY DISCHARGE (CFS)	OVERTOP DISCHARGE (CFS)	COMBINED DISCHARGE (CFS)
814	49	–	–	–	0
814.5	49.5	*10.10	–	–	10.
815	50	*28.6	–	–	29.
816	51	*80.77	–	–	81.
817	52	91.08	–	–	91.1
819.6	54.6	93.33	0	–	93.
820.85	55.85	94.39	104.49	–	199
821.37	56.37	94.83	251.14	294.72	641
822.99	57.99	96.18	1004.83	3580.78	4682.
824.49	59.49	97.41	1955.3	8316.4	10,369

* WEIR FLOW CONTROLS.

PLATE-2, APPENDIX-B



WOODRIDGE LAKE DAM (MO. 11005)
SPILLWAY & OVERTOP RATING CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

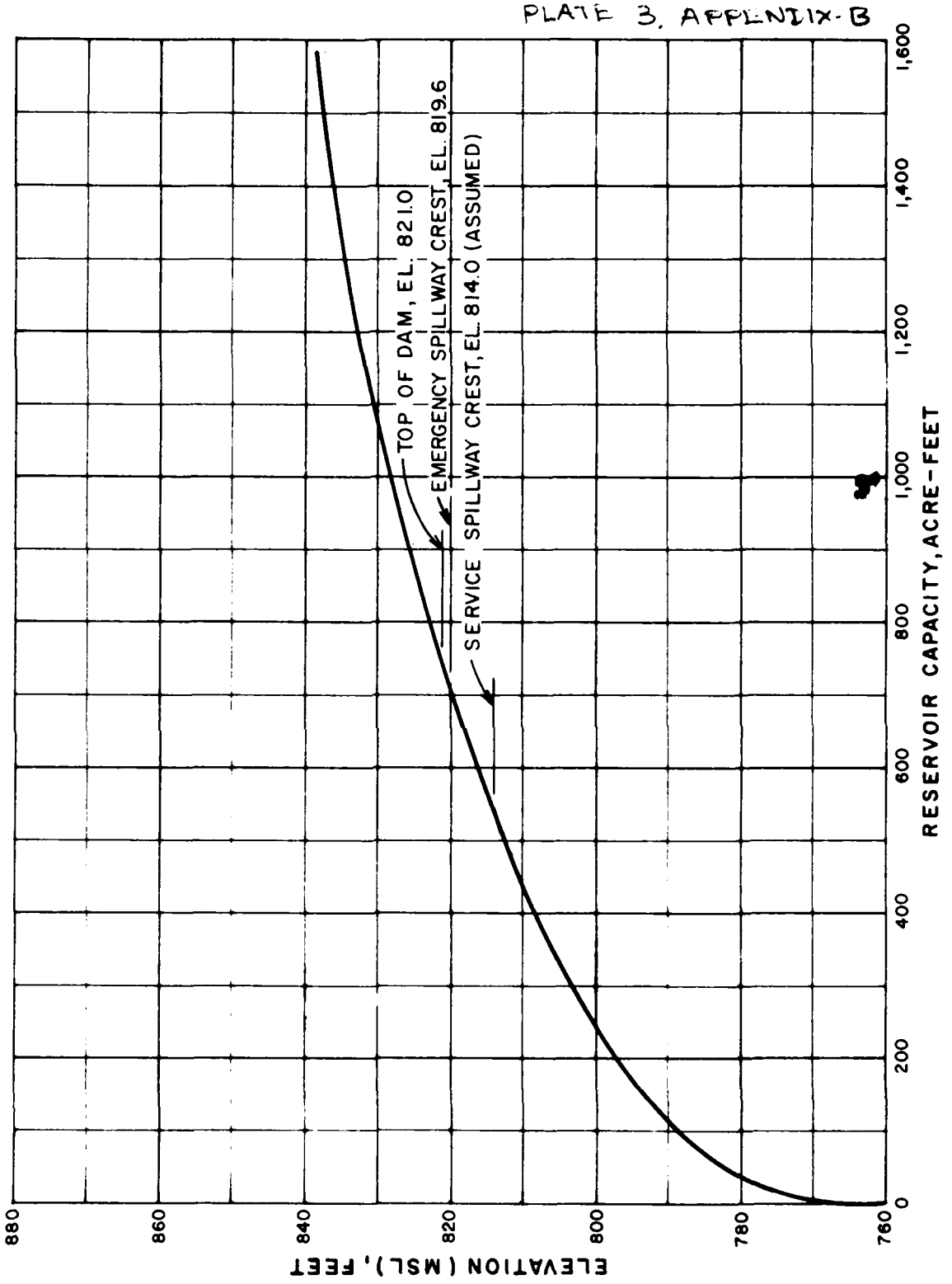
Dam Safety Inspection - Missouri SHEET NO. 1 OF
Woodridge Lake Dam - #11005 JOB NO. 1240
Reservoir Area Capacity BY M.R.H. DATE 5-22-79

WOODRIDGE LAKE DAM

Reservoir Area Capacity

Elev. M.S.L. (Ft)	Reservoir Surface Area (Acres)	Incremental Volume (Ac.-Ft.)	Total Volume (Ac.-Ft.)	Remarks
765	0	-	0	Est. Streambed @ Center of Dam
780	6.4	32	32	Area measured on U.S.G.S. map.
800	15.6	213	245	Area measured on U.S.G.S. map.
814	26	288	533	Service Spillway El. (Assumed)
819.6	31.7	161	694	Emergency Spillway Crest
820	32	13	707	Area measured on U.S.G.S. map.
821	35	33	740	Top of Dam
840	66	944	1684	Area measured on U.S.G.S. map.

PLATE 3, APPENDIX-B



WOODRIDGE LAKE DAM (MO. 11005)
RESERVOIR CAPACITY CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF
DAM # MO. 11005 — JOB NO. 1240-001
PROBABLE MAXIMUM PRECIPITATION — BY MAS DATE 5/22/79

DAM NO. MO. 11005

DETERMINATION OF PMP

1. Determine drainage area of the basin

   D.A. = 420 ACRES

2. Determine PMP Index Rainfall (For D.A. = 200 Sq Mi & 24 hrs. duration)

   Location of centroid of basin

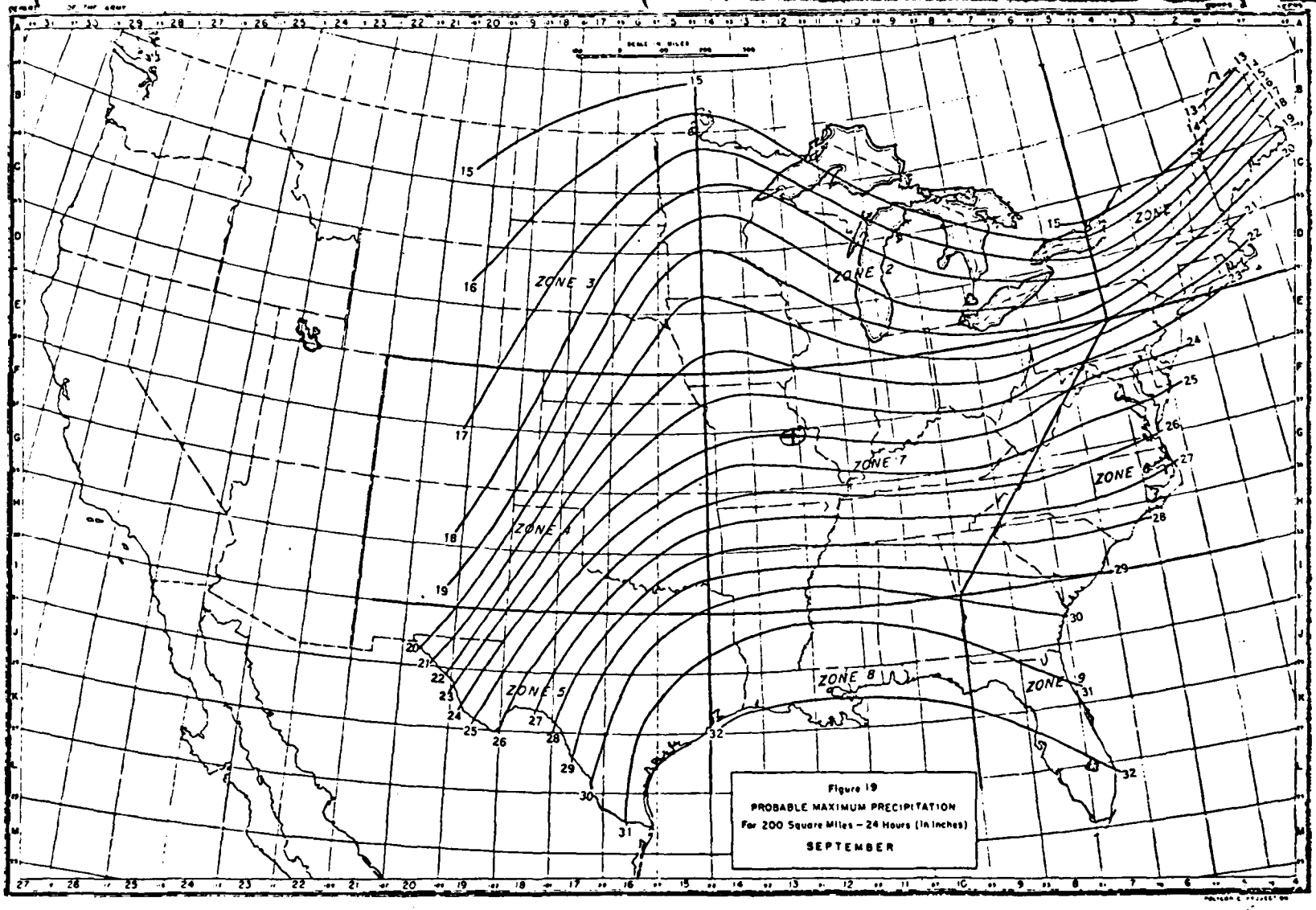
   Long. = 91°10'9", Lat. = 38°47'25" ⇒ PMP = 24.0" (From Fig 1 HMR 33)

3. Determine basin rainfall interms of percentage of PMP Index Rainfall for various durations.

   Location: Long. = 91°10'9", Lat. = 38°47'25",

   ⇒ Zone 7

Duration (Hrs.)	Percent of Index Rainfall (%)	Total Rainfall (Inches)	Rainfall Increment (Inches)	Duration of Increment (Hrs.)
6	100	24	24	6
12	120	28.8	4.8	6
24	130	31.2	2.4	12



PMP FOR ... SQ.M. - 24 HRS
= 24"

WOODRIDGE LAKE DAM (MO 11005)
LOCATION OF CENTRE OF WATERSHED:
LAT. = 38°47'25", LONG. = 91°10'09"

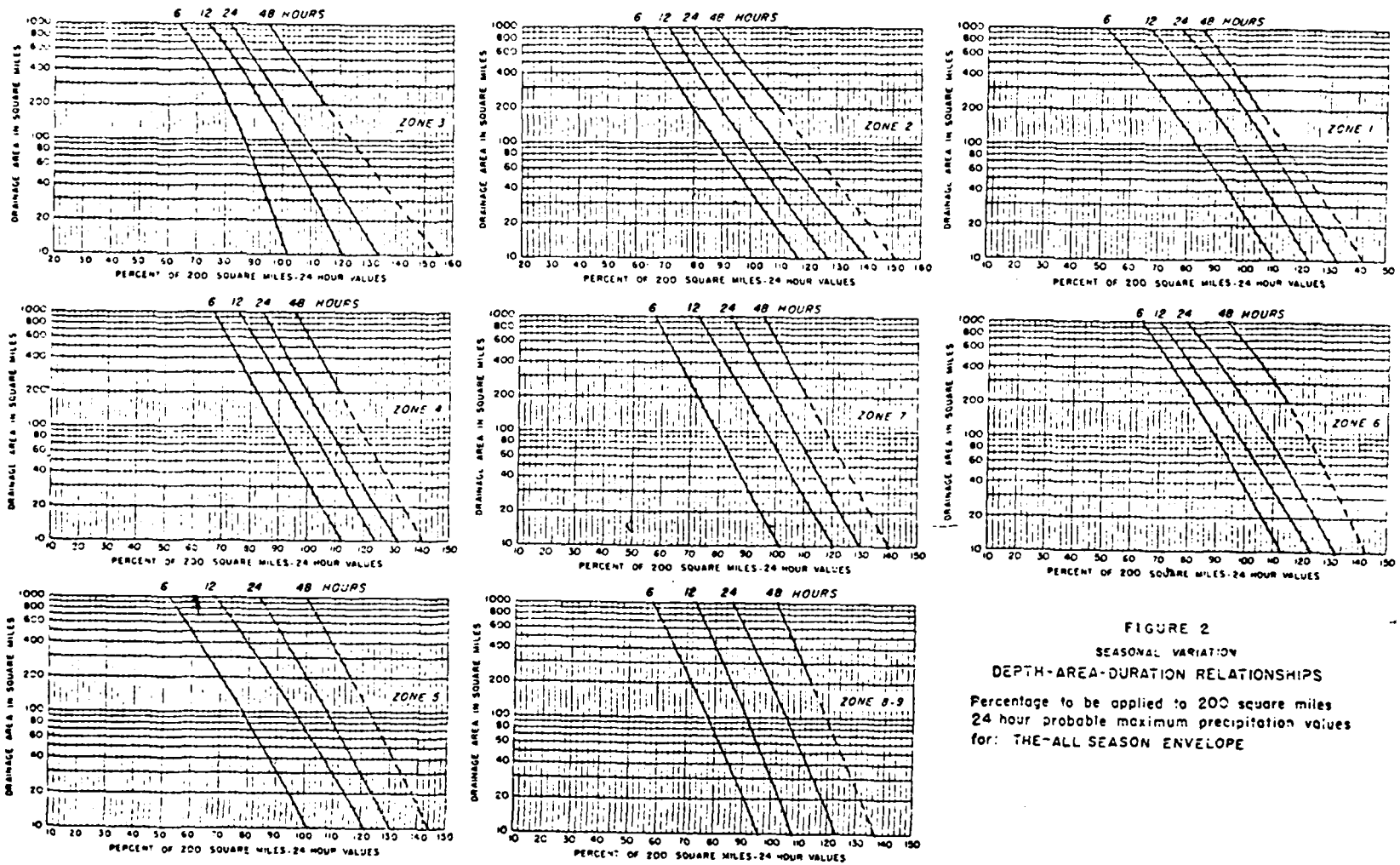


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for: THE ALL SEASON ENVELOPE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF ____
DAM # 11005 — JOB NO. 1240-001-1
UNIT HYDROGRAPH PARAMETERS — BY KLB DATE 5-30-7

1. DRAINAGE AREA, $A = 420\ Ac = 0.66$ SQ. mi.

2. LENGTH OF STREAM = (1.95" × 2000' = 3900) = 0.74 mi.

3. ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM, $H_1 = 930'$

4. RESERVOIR ELEVATION AT SPILLWAY CREST, $H_2 = 814'$

5. DIFFERENCE IN ELEVATION, $\Delta H = 930' - 814' = 116'$

6. AVERAGE SLOPE OF STREAM = $\frac{\Delta H}{L} = \frac{116}{3900} = 2.97\%$

7. TIME OF CONCENTRATION:

a) BY KIRPICH FORMULA:

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times 0.74^3}{116}\right)^{0.385} = 0.29 \text{ HR}$$

b) By VELOCITY ESTIMATE.

SLOPE = 2.9% ⇒ AVG. VELOCITY = 3 FPS.

$$\therefore T_c = \frac{0.79 \times 5280}{3 \times 60 \times 60} = 0.36 \text{ HR.}$$

USE $T_c = 0.30$ HR

8. LAG TIME = $L_t = 0.6 \times 0.30 = 0.18$ HR

9. UNIT DURATION $D \leq \frac{L_t}{3} = \frac{0.18}{3} = 0.06 < 0.083$

USE $D = 0.083$ HR = 5 MIN.

10. TIME TO PEAK, $T_p = \frac{D}{2} + L_t = \frac{0.083}{2} + 0.18$

$T_p = 0.22$ HR

11. PEAK DISCHARGE, $q_p = \frac{484 \cdot A}{T_p} = \frac{484 \cdot (0.66)}{0.22}$

$q_p = 1452$ CFS.

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION/MISSOURI SHEET NO. 1 OF
DAM # MO. 11005 JOB NO. 1240-001
DETERMINATION OF SOIL GROUP & CURVE NUMBER BY MAS DATE 5/31/79

MISSOURI DAM # MO 11005

DETERMINATION OF HYDROLOGIC SOIL GROUP & SCS CURVE NUMBER

1. Watershed Soils consist of B, C & D group Soils. Soil group D is predominent. Assume Soil group 'D' for the entire watershed.

2. Most of the watershed is wooded and covered with grass. Assume 'Fair' condition for infiltration purpose

Thus CN = 79 for group 'D' Soil & AMC-II

$\Rightarrow$ CN = 91 for AMC-III

HEC1DB INPUT DATA

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
     1             A                        DAM SAFETY INSPECTION - MISSOURI
     2             A                          WOODRIDGE LAKE DAM (11005)
     3             A              PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
     4             B    300        0         0         0         0         0         0         0         0         0
     5             R1     5
     6             J      1         2         1
     7             J1   1.0       0.5
     8             M      0     11005
     9             K1   INPUT INDEX PRECIPITATION AND RATIOS. INPUT SCS UNIT HYDROGRAPH PARAMETERS
    10             M      1         2      0.66                 0.66      1.0
    11             I              24.0       100       120       130
    12             I                                                          -1    -91.0
    13             M2             0.18
    14             X      0         0         1
    15             K      1     11005                             2                   1
    16             K1   ROUTE HYDROGRAPH THROUGH WOODRIDGE LAKE DAM
    17             Y                                          1         1
    18             Y1     1                                                  -814.0      -1
    19             Y2 814.0     814.5     815.0     816.0     817.0     819.6     820.85    821.00    821.37    822.99
    20             Y4824.49
    21             Y5     0.       10.       29.       81.       91.       93.      199.      203.      641.     4682.
    22             Y5103669.
    23             $S     0.       32.      245.      533.      544.      707.      740.     1684.
    24             $E   765.      780.      800.      814.      819.6     820.      821.      840.
    25             $$   814.
    26             $D   821.
    27             K     99
```

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 79/05/12.
TIME= 09.17.08.

DAM SAFETY INSPECTION - MISSOURI
WOODRIDGE LAKE DAM (11005)
PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0

JOPER	NRT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= 1.00 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11005	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.66	0.00	.66	1.00	0.000		0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-91.00	0.00	0.00

CURVE NO = -91.00 WETNESS = -1.00 EFFECT CN = 91.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .18

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 13 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .18 VOL= 1.00

804.	1289.	1390.	970.	491.	273.	167.	78.	43.	23.
18.	7.	2.							

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	END-OF-PERIOD FLOW MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	14.55	151	.20	.20	.00	981.
1.01	.10	2	.01	0.00	.01	0.	1.01	15.00	152	.20	.20	.00	993.
1.01	.15	3	.01	0.00	.01	0.	1.01	15.05	153	.20	.20	.00	999.
1.01	.20	4	.01	0.00	.01	0.	1.01	15.10	154	.20	.20	.00	1003.
1.01	.25	5	.01	0.00	.01	0.	1.01	15.15	155	.20	.20	.00	1005.
1.01	.30	6	.01	0.00	.01	0.	1.01	15.20	156	.20	.20	.00	1007.
1.01	.35	7	.01	0.00	.01	0.	1.01	15.25	157	.24	.24	.00	1024.
1.01	.40	8	.01	0.00	.01	0.	1.01	15.30	158	.24	.24	.00	1074.
1.01	.45	9	.01	0.00	.01	0.	1.01	15.35	159	.24	.24	.00	1130.
1.01	.50	10	.01	0.00	.01	0.	1.01	15.40	160	.24	.24	.00	1149.
1.01	.55	11	.01	0.00	.01	0.	1.01	15.45	161	.24	.24	.00	1189.
1.01	1.00	12	.01	0.00	.01	0.	1.01	15.50	162	.24	.24	.00	1201.
1.01	1.05	13	.01	0.00	.01	0.	1.01	15.55	163	.24	.24	.00	1207.
1.01	1.10	14	.01	0.00	.01	0.	1.01	16.00	164	.24	.24	.00	1211.
1.01	1.15	15	.01	.00	.01	0.	1.01	16.05	165	.24	.24	.00	1213.
1.01	1.20	16	.01	.00	.01	0.	1.01	16.10	166	.24	.24	.00	1215.
1.01	1.25	17	.01	.00	.01	1.	1.01	16.15	167	.24	.24	.00	1216.
1.01	1.30	18	.01	.00	.01	1.	1.01	16.20	16	.24	.24	.00	1216.
1.01	1.35	19	.01	.00	.01	1.	1.01	16.25	169	.30	.30	.00	1241.
1.01	1.40	20	.01	.00	.01	4.	1.01	16.30	170	.30	.30	.00	1316.
1.01	1.45	21	.01	.00	.01	6.	1.01	16.35	171	.30	.30	.00	1400.
1.01	1.50	22	.01	.00	.01	7.	1.01	16.40	172	.30	.30	.00	1458.
1.01	1.55	23	.01	.00	.01	9.	1.01	16.45	173	.30	.30	.00	1498.
1.01	2.00	24	.01	.00	.01	10.	1.01	16.50	174	.30	.30	.00	1505.
1.01	2.05	25	.01	.00	.01	11.	1.01	16.55	175	.30	.30	.00	1514.
1.01	2.10	26	.01	.00	.01	13.	1.01	17.00	176	.30	.30	.00	1519.
1.01	2.15	27	.01	.00	.01	14.	1.01	17.05	177	.30	.30	.00	1522.
1.01	2.20	28	.01	.00	.01	15.	1.01	17.10	178	.30	.30	.00	1523.
1.01	2.25	29	.01	.00	.01	17.	1.01	17.15	179	.30	.30	.00	1525.
1.01	2.30	30	.01	.00	.01	18.	1.01	17.20	180	.30	.30	.00	1525.
1.01	2.35	31	.01	.00	.01	19.	1.01	17.25	181	.18	.18	.00	1478.
1.01	2.40	32	.01	.00	.01	20.	1.01	17.30	182	.36	.36	.00	1484.
1.01	2.45	33	.01	.00	.01	21.	1.01	17.35	183	.36	.36	.00	1470.
1.01	2.50	34	.01	.00	.01	22.	1.01	17.40	184	.66	.66	.00	1684.
1.01	2.55	35	.01	.01	.01	23.	1.01	17.45	185	.66	.66	.00	2068.
1.01	3.00	36	.01	.01	.01	24.	1.01	17.50	186	1.55	1.55	.00	3862.
1.01	3.05	37	.01	.01	.01	27.	1.01	17.55	187	2.55	2.55	.01	4748.
1.01	3.10	38	.01	.01	.01	28.	1.01	18.00	188	1.00	1.00	.00	6891.
1.01	3.15	39	.01	.01	.01	27.	1.01	18.05	189	.64	.64	.00	7143.
1.01	3.20	40	.01	.01	.01	28.	1.01	18.10	190	.65	.65	.00	5961.
1.01	3.25	41	.01	.01	.01	29.	1.01	18.15	191	.36	.36	.00	4586.
1.01	3.30	42	.01	.01	.01	29.	1.01	18.20	192	.36	.36	.00	3470.
1.01	3.35	43	.01	.01	.01	30.	1.01	18.25	193	.24	.24	.00	2740.
1.01	3.40	44	.01	.01	.01	31.	1.01	18.30	194	.28	.28	.00	2267.
1.01	3.45	45	.01	.01	.01	32.	1.01	18.35	195	.28	.28	.00	1867.
1.01	3.50	46	.01	.01	.01	32.	1.01	18.40	196	.28	.28	.00	1668.
1.01	3.55	47	.01	.01	.01	33.	1.01	18.45	197	.28	.28	.00	1557.
1.01	4.00	48	.01	.01	.01	34.	1.01	18.50	198	.28	.28	.00	1495.
1.01	4.05	49	.01	.01	.01	34.	1.01	18.55	199	.28	.28	.00	1458.
1.01	4.10	50	.01	.01	.01	35.	1.01	19.00	200	.28	.28	.00	1441.
1.01	4.15	51	.01	.01	.01	35.	1.01	19.05	201	.28	.28	.00	1434.
1.01	4.20	52	.01	.01	.01	36.	1.01	19.10	202	.28	.28	.00	1431.
1.01	4.25	53	.01	.01	.01	37.	1.01	19.15	203	.28	.28	.00	1429.
1.01	4.30	54	.01	.01	.01	37.	1.01	19.20	204	.28	.28	.00	1429.
1.01	4.35	55	.01	.01	.01	38.	1.01	19.25	205	.22	.22	.00	1404.
1.01	4.40	56	.01	.01	.01	38.	1.01	19.30	206	.22	.22	.00	1329.

1.01	4.45	57	.01	.01	.01	39.	1.01	17.15	207	.02	.02	.00	1245.
1.01	4.50	58	.01	.01	.01	39.	1.01	17.20	208	.02	.02	.00	1187.
1.01	4.55	59	.01	.01	.01	40.	1.01	17.25	209	.02	.02	.00	1158.
1.01	5.00	60	.01	.01	.01	40.	1.01	17.30	210	.02	.02	.00	1141.
1.01	5.05	61	.01	.01	.01	41.	1.01	17.35	211	.02	.02	.00	1132.
1.01	5.10	62	.01	.01	.01	41.	1.01	17.40	212	.02	.02	.00	1128.
1.01	5.15	63	.01	.01	.00	42.	1.01	17.45	213	.02	.02	.00	1126.
1.01	5.20	64	.01	.01	.00	42.	1.01	17.50	214	.02	.02	.00	1124.
1.01	5.25	65	.01	.01	.00	43.	1.01	17.55	215	.02	.02	.00	1123.
1.01	5.30	66	.01	.01	.00	43.	1.01	18.00	216	.02	.02	.00	1123.
1.01	5.35	67	.01	.01	.00	43.	1.01	18.05	217	.02	.02	.00	1042.
1.01	5.40	68	.01	.01	.00	44.	1.01	18.10	218	.02	.02	.00	799.
1.01	5.45	69	.01	.01	.00	44.	1.01	18.15	219	.02	.02	.00	611.
1.01	5.50	70	.01	.01	.00	45.	1.01	18.20	220	.02	.02	.00	517.
1.01	5.55	71	.01	.01	.00	45.	1.01	18.25	221	.02	.02	.00	219.
1.01	6.00	72	.01	.01	.00	45.	1.01	18.30	222	.02	.02	.00	165.
1.01	6.05	73	.07	.04	.02	61.	1.01	18.35	223	.02	.02	.00	135.
1.01	6.10	74	.07	.05	.02	108.	1.01	18.40	224	.02	.02	.00	120.
1.01	6.15	75	.07	.05	.02	165.	1.01	18.45	225	.02	.02	.00	111.
1.01	6.20	76	.07	.05	.02	203.	1.01	18.50	226	.02	.02	.00	106.
1.01	6.25	77	.07	.05	.02	226.	1.01	18.55	227	.02	.02	.00	104.
1.01	6.30	78	.07	.05	.01	242.	1.01	19.00	228	.02	.02	.00	102.
1.01	6.35	79	.07	.05	.01	252.	1.01	19.05	229	.02	.02	.00	102.
1.01	6.40	80	.07	.05	.01	260.	1.01	19.10	230	.02	.02	.00	102.
1.01	6.45	81	.07	.05	.01	267.	1.01	19.15	231	.02	.02	.00	102.
1.01	6.50	82	.07	.06	.01	272.	1.01	19.20	232	.02	.02	.00	102.
1.01	6.55	83	.07	.06	.01	276.	1.01	19.25	233	.02	.02	.00	102.
1.01	7.00	84	.07	.06	.01	280.	1.01	19.30	234	.02	.02	.00	102.
1.01	7.05	85	.07	.06	.01	283.	1.01	19.35	235	.02	.02	.00	102.
1.01	7.10	86	.07	.06	.01	286.	1.01	19.40	236	.02	.02	.00	102.
1.01	7.15	87	.07	.06	.01	289.	1.01	19.45	237	.02	.02	.00	102.
1.01	7.20	88	.07	.06	.01	292.	1.01	19.50	238	.02	.02	.00	102.
1.01	7.25	89	.07	.06	.01	294.	1.01	19.55	239	.02	.02	.00	102.
1.01	7.30	90	.07	.06	.01	296.	1.01	20.00	240	.02	.02	.00	102.
1.01	7.35	91	.07	.06	.01	298.	1.01	20.05	241	.02	.02	.00	102.
1.01	7.40	92	.07	.06	.01	300.	1.01	20.10	242	.02	.02	.00	102.
1.01	7.45	93	.07	.06	.01	302.	1.01	20.15	243	.02	.02	.00	102.
1.01	7.50	94	.07	.06	.01	304.	1.01	20.20	244	.02	.02	.00	102.
1.01	7.55	95	.07	.06	.01	305.	1.01	20.25	245	.02	.02	.00	102.
1.01	8.00	96	.07	.06	.01	307.	1.01	20.30	246	.02	.02	.00	102.
1.01	8.05	97	.07	.06	.01	308.	1.01	20.35	247	.02	.02	.00	102.
1.01	8.10	98	.07	.06	.01	310.	1.01	20.40	248	.02	.02	.00	102.
1.01	8.15	99	.07	.06	.01	311.	1.01	20.45	249	.02	.02	.00	102.
1.01	8.20	100	.07	.06	.01	312.	1.01	20.50	250	.02	.02	.00	102.
1.01	8.25	101	.07	.06	.00	313.	1.01	20.55	251	.02	.02	.00	102.
1.01	8.30	102	.07	.06	.00	314.	1.01	21.00	252	.02	.02	.00	102.
1.01	8.35	103	.07	.06	.00	315.	1.01	21.05	253	.02	.02	.00	102.
1.01	8.40	104	.07	.06	.00	316.	1.01	21.10	254	.02	.02	.00	102.
1.01	8.45	105	.07	.06	.00	317.	1.01	21.15	255	.02	.02	.00	102.
1.01	8.50	106	.07	.06	.00	318.	1.01	21.20	256	.02	.02	.00	102.
1.01	8.55	107	.07	.06	.00	318.	1.01	21.25	257	.02	.02	.00	102.
1.01	9.00	108	.07	.06	.00	319.	1.01	21.30	258	.02	.02	.00	102.
1.01	9.05	109	.07	.06	.00	320.	1.01	21.35	259	.02	.02	.00	102.
1.01	9.10	110	.07	.06	.00	321.	1.01	21.40	260	.02	.02	.00	102.
1.01	9.15	111	.07	.06	.00	321.	1.01	21.45	261	.02	.02	.00	102.
1.01	9.20	112	.07	.06	.00	322.	1.01	21.50	262	.02	.02	.00	102.
1.01	9.25	113	.07	.06	.00	322.	1.01	21.55	263	.02	.02	.00	102.
1.01	9.30	114	.07	.06	.00	323.	1.01	22.00	264	.02	.02	.00	102.
1.01	9.35	115	.07	.06	.00	323.	1.01	22.05	265	.02	.02	.00	102.
1.01	9.40	116	.07	.06	.00	324.	1.01	22.10	266	.02	.02	.00	102.

1.01	9.45	117	.07	.06	.00	324.	1.01	22.15	267	.02	.02	.00	102.
1.01	9.50	118	.07	.06	.00	325.	1.01	22.20	268	.02	.02	.00	102.
1.01	9.55	119	.07	.06	.00	325.	1.01	22.25	269	.02	.02	.00	102.
1.01	10.00	120	.07	.06	.00	326.	1.01	22.30	270	.02	.02	.00	102.
1.01	10.05	121	.07	.06	.00	326.	1.01	22.35	271	.02	.02	.00	102.
1.01	10.10	122	.07	.06	.00	327.	1.01	22.40	272	.02	.02	.00	102.
1.01	10.15	123	.07	.06	.00	327.	1.01	22.45	273	.02	.02	.00	102.
1.01	10.20	124	.07	.06	.00	327.	1.01	22.50	274	.02	.02	.00	102.
1.01	10.25	125	.07	.06	.00	328.	1.01	22.55	275	.02	.02	.00	102.
1.01	10.30	126	.07	.06	.00	328.	1.01	23.00	276	.02	.02	.00	102.
1.01	10.35	127	.07	.06	.00	328.	1.01	23.05	277	.02	.02	.00	102.
1.01	10.40	128	.07	.06	.00	329.	1.01	23.10	278	.02	.02	.00	102.
1.01	10.45	129	.07	.06	.00	329.	1.01	23.15	279	.02	.02	.00	102.
1.01	10.50	130	.07	.06	.00	329.	1.01	23.20	280	.02	.02	.00	102.
1.01	10.55	131	.07	.06	.00	329.	1.01	23.25	281	.02	.02	.00	102.
1.01	11.00	132	.07	.06	.00	330.	1.01	23.30	282	.02	.02	.00	102.
1.01	11.05	133	.07	.06	.00	330.	1.01	23.35	283	.02	.02	.00	102.
1.01	11.10	134	.07	.06	.00	330.	1.01	23.40	284	.02	.02	.00	102.
1.01	11.15	135	.07	.06	.00	330.	1.01	23.45	285	.02	.02	.00	102.
1.01	11.20	136	.07	.06	.00	331.	1.01	23.50	286	.02	.02	.00	102.
1.01	11.25	137	.07	.06	.00	331.	1.01	23.55	287	.02	.02	.00	102.
1.01	11.30	138	.07	.06	.00	331.	1.02	0.00	288	.02	.02	.00	102.
1.01	11.35	139	.07	.06	.00	331.	1.02	.05	288	0.00	0.00	0.00	94.
1.01	11.40	140	.07	.06	.00	332.	1.02	.10	290	0.00	0.00	0.00	69.
1.01	11.45	141	.07	.07	.00	332.	1.02	.15	291	0.00	0.00	0.00	41.
1.01	11.50	142	.07	.07	.00	332.	1.02	.20	292	0.00	0.00	0.00	22.
1.01	11.55	143	.07	.07	.00	332.	1.02	.25	293	0.00	0.00	0.00	12.
1.01	12.00	144	.07	.07	.00	332.	1.02	.30	294	0.00	0.00	0.00	6.
1.01	12.05	145	.20	.20	.00	385.	1.02	.35	295	0.00	0.00	0.00	3.
1.01	12.10	146	.20	.20	.00	550.	1.02	.40	296	0.00	0.00	0.00	2.
1.01	12.15	147	.20	.20	.00	732.	1.02	.45	297	0.00	0.00	0.00	1.
1.01	12.20	148	.20	.20	.00	860.	1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.20	.20	.00	925.	1.02	.55	299	0.00	0.00	0.00	0.
1.01	12.30	150	.20	.20	.00	961.	1.02	1.00	300	0.00	0.00	0.00	0.
									SUM	31.20	30.04	1.16	15346.
										(792.)	(763.)	(29.)	(4345.)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7143.	1679.	533.	512.	15346.
CMS	202.	48.	15.	14.	434.
INCHES		23.66	30.04	30.04	30.04
MM		600.91	763.11	763.11	763.11
AC-FT		853.	1057.	1057.	1057.
THOUS CU M		1027.	1304.	1304.	1304.

HYDROGRAPH AT STA 11005 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	3.	4.
6.	7.	9.	10.	11.	13.	14.	15.	17.	18.
19.	20.	21.	22.	23.	24.	25.	26.	27.	28.
29.	29.	30.	31.	32.	32.	33.	34.	34.	35.
36.	36.	37.	37.	38.	38.	39.	39.	40.	40.
41.	41.	42.	42.	43.	43.	43.	44.	44.	45.
45.	45.	61.	108.	163.	203.	226.	242.	252.	260.
267.	272.	276.	280.	283.	286.	289.	292.	294.	296.
298.	300.	302.	304.	305.	307.	308.	310.	311.	312.
313.	314.	315.	316.	317.	318.	318.	319.	320.	321.

321.	322.	322.	323.	323.	324.	324.	325.	325.	326.
326.	327.	327.	327.	328.	328.	328.	329.	329.	329.
329.	330.	330.	330.	330.	331.	331.	331.	331.	332.
332.	332.	332.	332.	395.	550.	732.	860.	925.	961.
981.	993.	993.	1003.	1005.	1007.	1024.	1074.	1130.	1169.
1193.	1201.	1207.	1211.	1213.	1215.	1216.	1216.	1241.	1316.
1400.	1458.	1488.	1500.	1514.	1519.	1522.	1523.	1525.	1525.
1473.	1434.	1470.	1684.	2068.	2862.	4748.	6851.	7143.	5961.
4536.	3490.	2740.	2207.	1867.	1664.	1557.	1495.	1458.	1441.
1436.	1431.	1419.	1429.	1403.	1329.	1245.	1187.	1168.	1141.
1132.	1128.	1125.	1124.	1123.	1123.	1042.	790.	511.	317.
219.	165.	135.	120.	111.	106.	104.	102.	102.	102.
102.	102.	102.	102.	102.	102.	102.	102.	102.	102.
102.	102.	102.	102.	102.	102.	102.	102.	102.	102.
102.	102.	102.	102.	102.	102.	102.	102.	102.	102.
102.	102.	102.	102.	102.	102.	102.	102.	102.	102.
102.	102.	102.	102.	102.	102.	102.	102.	102.	102.
102.	102.	102.	102.	102.	102.	102.	102.	94.	69.
41.	22.	12.	6.	3.	2.	1.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7143.	1673.	973.	512.	153476.
CMS	202.	48.	15.	14.	4346.
INCHES	---	23.56	30.04	30.04	30.04
AC-FT		600.91	763.11	763.11	763.11
THOUS CU M		832.	1057.	1057.	1057.
		1027.	1304.	1304.	1304.

HYDROGRAPH AT STA 11008 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	2.
3.	4.	4.	5.	6.	6.	7.	8.	8.	9.
9.	10.	11.	11.	12.	12.	13.	13.	13.	14.
14.	15.	15.	15.	16.	16.	17.	17.	17.	17.
18.	18.	18.	19.	19.	19.	19.	20.	20.	20.
20.	21.	21.	21.	21.	22.	22.	22.	22.	22.
23.	25.	30.	54.	81.	101.	113.	121.	126.	130.
132.	136.	138.	140.	142.	143.	145.	146.	147.	148.
149.	150.	151.	152.	153.	153.	154.	155.	155.	156.
157.	157.	158.	158.	158.	159.	159.	160.	160.	160.
161.	161.	161.	161.	162.	162.	162.	162.	163.	163.
163.	163.	163.	164.	164.	164.	164.	164.	164.	165.
165.	165.	165.	165.	165.	165.	165.	166.	166.	166.
166.	166.	166.	166.	193.	275.	366.	430.	462.	481.
491.	496.	500.	501.	503.	504.	512.	537.	565.	585.
595.	600.	604.	605.	607.	607.	608.	608.	620.	650.
708.	728.	744.	752.	757.	759.	761.	762.	762.	763.
739.	702.	735.	842.	1034.	1431.	2374.	3426.	3571.	2981.
2268.	1745.	1370.	1104.	934.	832.	778.	747.	729.	721.
717.	715.	715.	714.	702.	664.	623.	594.	579.	571.
566.	564.	563.	562.	562.	561.	521.	395.	256.	159.
110.	82.	68.	60.	56.	53.	52.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	47.	34.

804.	11.	6.	3.	2.	1.	0.	0.	0.	0.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3571.	839.	266.	256.	7673.
CMS	101.	24.	8.	7.	2173.
INCHES		11.83	15.02	15.02	15.02
MM		300.46	381.56	381.56	381.56
AC-FT		416.	528.	528.	528.
THOUS CU M		513.	652.	652.	652.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH WOODRIDGE LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11005	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-814.	-1

STAGE	814.00	814.50	815.00	816.00	817.00	819.60	820.85	821.00	821.37	822.99
	824.49									
FLOW	0.00	10.00	29.00	81.00	91.00	95.00	199.00	233.00	641.00	4682.00
	10369.00									
CAPACITY=	0.	32.	245.	533.	694.	707.	740.	1688.		
ELEVATION=	765.	780.	800.	814.	820.	820.	821.	840.		

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
814.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
821.0	0.0	0.0	0.

STATION 11005, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
2.	2.	2.	2.	2.	2.	3.	3.	3.	3.
3.	3.	3.	4.	4.	4.	4.	4.	5.	5.
5.	5.	5.	5.	6.	6.	6.	6.	6.	6.
7.	7.	7.	7.	8.	9.	10.	12.	14.	16.
18.	21.	23.	25.	27.	30.	33.	36.	40.	43.

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	11005	.66	1	7143.	3571.
		(1.71)		(202.26)(	101.13)(
ROUTED TO	11004	.66	1	5259.	2329.
		(1.71)		(148.91)(	65.94)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	814.00	814.00	821.00
STORAGE	533.	533.	740.
OUTFLOW	0.	0.	203.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	823.14	2.14	846.	5259.	6.00	15.83	0.00
.50	822.05	1.05	792.	2325.	3.42	15.92	0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  28 FEB 79
**********

RUN  DATE= 79/06/12.
     TIME= 09.16.55.
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DAM SAFETY INSPECTION - MISSOURI
WOODRIDGE LAKE DAM (11005)
PERCENT OF PMP DETERMINATION AND ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	2	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= .25 .26 .27 .28 .29 .30 .31 .32 .33

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SUB-AREA RUNOFF COMPUTATION

INPUT INDEX PRECIPITATION AND RATIOS. INPUT SCS UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11005	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.66	0.00	.66	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-91.00	0.00	0.00

CURVE NO = -91.00 WETNESS = -1.00 EFFECT CN = 91.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .18

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 31.20 30.04 1.16 15346B.
(792.1(763.3(29.3(4345.64)

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH WOODRIDGE LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11005	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-814.	-1

STAGE	814.00 824.49	814.50	815.00	816.00	817.00	819.60	820.85	821.00	821.37	822.99
FLOW	0.00 10369.00	10.00	99.00	81.00	91.00	93.00	199.00	207.00	641.00	4282.00
CAPACITY=	0.	32.	245.	535.	694.	707.	740.	1884.		
ELEVATION=	765.	780.	800.	814.	820.	820.	821.	840.		

CREL	SPWID	COQW	EXPW	FLEVL	COQL	CAREA	EXPL
814.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
821.0	0.0	0.0	0.

PEAK OUTFLOW IS 172. AT TIME 18.17 HOURS

PEAK OUTFLOW IS 188. AT TIME 18.17 HOURS

PEAK OUTFLOW IS 201. AT TIME 18.17 HOURS

PEAK OUTFLOW IS 262. AT TIME 18.08 HOURS

PEAK OUTFLOW IS 311. AT TIME 18.08 HOURS

PEAK OUTFLOW IS 344. AT TIME 17.50 HOURS

PEAK OUTFLOW IS 398. AT TIME 17.25 HOURS

PEAK OUTFLOW IS 428. AT TIME 17.17 HOURS

PEAK OUTFLOW IS 462. AT TIME 17.00 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				.25	.26	.27	.28	.29	.30	.31	.32	.33
HYDROGRAPH AT	11005	.66	1	1786.	1857.	1928.	2000.	2071.	2143.	2214.	2286.	2357.
		(1.71)		(50.56)(	52.59)(	54.61)(	56.63)(	58.65)(	60.68)(	62.70)(	64.72)(	66.74)
ROUTED TO	11005	.66	1	172.	186.	201.	216.	311.	344.	390.	428.	462.
		(1.71)		(4.87)(	5.31)(	5.69)(	7.41)(	8.81)(	9.75)(	11.04)(	12.13)(	13.09)

AD-A105 011 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. WOODRIDGE LAKE DAM (MO 11005), MIS--ETC(U)
SEP 79 W G SHIFRIN DACW43-79-C-0075
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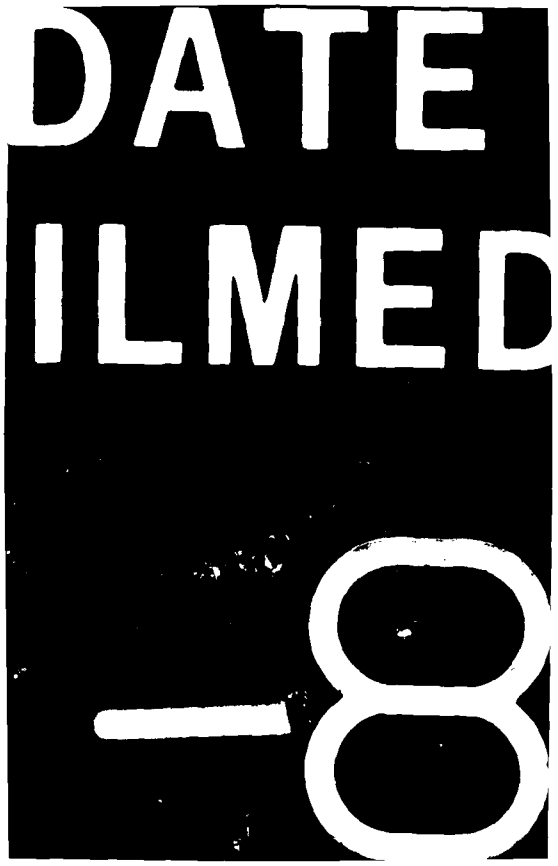
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 **********

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	814.00	814.00	821.00
STORAGE	533.	533.	740.
OUTFLOW	0.	0.	203.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.25	820.53	0.00	725.	172.	0.00	19.17	0.00
.26	820.72	0.00	731.	188.	0.00	19.17	0.00
.27	820.91	0.00	737.	201.	0.00	19.17	0.00
.28	821.05	.05	742.	262.	.75	19.08	0.00
.29	821.09	.09	745.	311.	1.42	18.08	0.00
.30	821.12	.12	746.	348.	1.83	17.50	0.00
.31	821.16	.16	748.	390.	2.25	17.25	0.00
.32	821.19	.19	749.	428.	2.42	17.17	0.00
.33	821.22	.22	751.	462.	2.58	17.08	0.00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